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THE MUSK DUCK.

VOLUME 20, No. 1.

DECEMBER 30, 1939.

Registered at the G.P.O.,
Adelaide, for transmission
through the post as a
periodical.

The South Australian NATURALIST

JOURNAL OF THE FIELD NATURALISTS' SECTION OF THE
ROYAL SOCIETY OF SOUTH AUSTRALIA.

Price: One Shilling.

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of The Royal Society of South Australia

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The Quaint Musk Duck

(*BIZIURA LOBATA*)

By

H. T. CONDON.

Assistant Zoologist, South Australian Museum.

Animals can often be recognised by certain odours which they possess, and birds are no exception. Many species have characteristic odours which cling to the feathers long after the death of the bird. Skins of sea birds, notably those of Petrels, Prions and Albatrosses, retain the powerful odours of these birds for many decades, as do also those of most Cockatoos and Parrots. So intense are these odours that they quickly permeate their surroundings and contaminate everything with which they come into contact.

Although we generally think of ducks as being of somewhat unclean habits, it is a strange fact that the feathers of most of our Australian wild species exhibit no kind of odour when preserved as skins. The exception is the Musk Duck (*Biziura lobata*) which in the adult possesses an arresting odour generally described as "musky." From the evidence available it seems that this odour is produced in the breeding season, but by some authors it is stated to occur only in males, while by others it is said to be characteristic of the brooding female. The origin of the scent is unknown, and although it is probably secreted by certain glands, these have never been described or located.

An old male, recently taken at Tailem Bend, River Murray, South Australia, on 18th October, 1939, possessed the strong musky smell, which in all probability occurs in both sexes.

From its retiring habits, its love of secluded backwaters, and its reluctance to fly when approached, the Musk Duck is little known to most people, who fail to recognise it when captured. It is not a "sporting" duck, because it is rarely seen on the wing, and being an expert swimmer and diver, it generally resorts to this practice to escape. This habit, together with the smallness of the wings, has given rise to the popular but erroneous belief

that the birds cannot fly. There are many records to the contrary. On one occasion¹, in Western Australia, a Musk Duck was shot in mistake for a Black Duck by one of a party of duck-shooters; "the bird was flying high . . . and was going very fast. . . . This occurred *just at dusk*."

Most ducks move about mainly at night, this habit perhaps being due to an induced wariness and cunning produced after many years of persecution by man. The Musk Duck is no exception, and there are many records of it disappearing from dams, lagoons and other small sheets of water over night.

The cover illustration shows the distinctive wattle or lobe by which the species



Distribution of the Musk Duck,
with silhouette on left.

may usually be recognised. This bird was a male, captured at Tailem Bend on 24th August, 1938; it weighed 6½ lb. Another male taken since that time (see above), weighed 8½ lb. Old males grow to a huge size, and thus do not easily fall prey to predatory hawks which will attack other species of ducks and water fowl.

Occasionally, large individuals are seen with a very small lobe, or it may even be entirely absent. Forbes² (1882) believed the lobe was analogous to the wattle of the male of other birds, and was in some way connected with display during sexual excitement. Since then, however, adult females have also been obtained with large wattles, although this is rather unusual. In life, the wattle is black in color and quite soft and fleshy, so that it dangles from side to side as the bird moves its head. Certain accounts erroneously refer to it as being "leathery" in nature. The function of the structure is unknown, and it has been described as being simply formed by a fold of the integuments so that there is no cavity within. The structure becomes enlarged in the breeding season, and certain writers have referred to the distended "pouch" of these birds when displaying. Inside the mouth, beneath the tongue, is a small circular aperture, which leads into a kind of groove which extends backwards to the base of the tongue and forwards close to the base of the wattle, although there is no apparent connection between the two. The inside of the mouth is flesh pink in color. Generally speaking, it may be said that the wattle is larger in males than in females, but varies in shape and size with the individual, and may even be entirely absent, while in the breeding season it is larger than at other times.

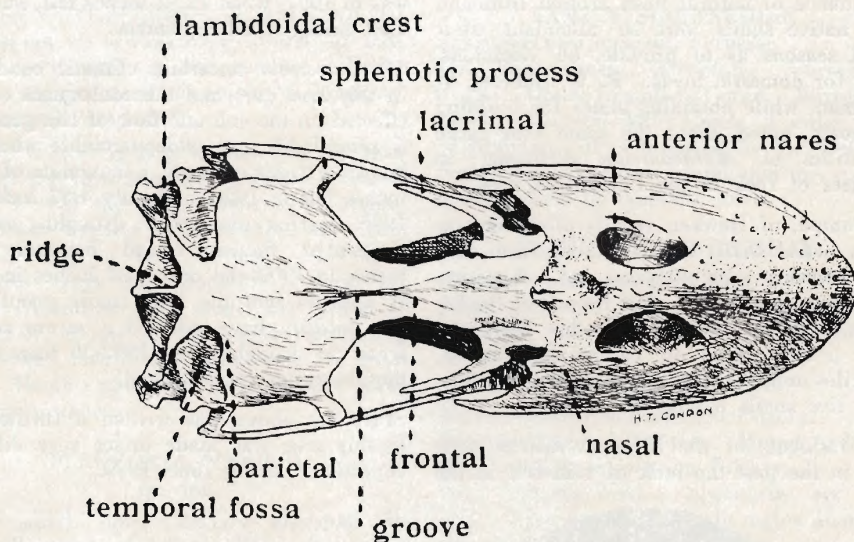
The nearest relatives of the Musk Duck are the stiff-tailed Ruddy Ducks (*Oxyurinae*) of which the Australian Blue-billed Duck (*Oxyura australis*) is an example. The female of the Blue-billed Duck bears a strong resemblance to a light-colored Musk Duck, and in the field is only distinguished therefrom by the absence of a wattle, and the somewhat smaller size, and by the fact that the body is usually not as submerged when swimming as in the Musk Duck, i.e., the bird may sit "higher" on the water. The Blue-billed Duck also rarely flies, but is an expert diver and swimmer.

Owing to its diving habits the hind limbs and pelvic girdle of the Musk Duck are somewhat different from those of many ducks, and resemble the condition seen in the specialised aquatic grebes, which are also expert swim-

mers and divers. Some accounts mention a minute claw on the pollex (or thumb) of the wing, but while this occurs in juveniles (at least up to 12 inches long) it is apparently absent in most adults.

The Musk Duck is a solitary species, usually occurring in pairs, although the bays of Lake Albert and elsewhere may be literally dotted with them at certain times of the year, e.g., early in June (1936). The birds are very wary, and usually keep some distance from a boat. Except on certain occasions, they seem to avoid the company of other water birds, although they have been seen diving among other water fowl, apparently in playful mood and much to the alarm of those birds. Often while swimming they will go through a number of strange antics, to the accompaniment of much loud splashing and kicking of the legs. Often they will swim around rapidly in a circle, occasionally uttering a low one-note whistle. These birds are apparently males. When kicking and displaying, the beak is held upwards and the head is thrown back, and at such times the pendant wattle can be clearly seen dangling from side to side. Another sound made by the Musk Duck while swimming is a loud "plongk," but it is difficult to decide whether this is vocal, or produced by a kicking and splashing of the water.

The Musk Duck feeds on water plants and animal life, in fresh and salt water. B. C. Cotton has taken the large freshwater snail, *Limnoea lessona*, also *Hyridella australis* and *Corbiculina angasi* from the gullet of a bird taken at Mannum in January, 1938. Much more is still required to be known about the food and economy of these birds however. The nest is usually made near water among reeds, at the foot of a tree, or in polygonum swamps, and is a bulky structure, often with a hood, and an entrance at one side, or with two entrances at opposite ends. It is usually bowl-shaped and lined with down. Well-known breeding places in South Australia occur on the polygonum swamps of the River Murray, on many of the islands of the Murray mouth (e.g., Hindmarsh Island), and in the south-east of the State at such places as St. Helena Swamp and Bool Lagoon.



The Skull of the Musk Duck, showing its main features from above, natural size.

The nearest breeding place to Adelaide at present is probably Buckland Park, near Port Gawler, although many years ago they commonly occurred at the Reedbeds and on the lower reaches of River Torrens. They also breed in the far north of the State in favorable seasons. The Musk Duck lays three to six pale green, slightly glossy eggs, each about $3\frac{1}{2}$ inches long, and the breeding season extends from August to December.

The Musk Duck is confined to the southern half of the Australian continent, including Tasmania, and there has only been one sporadic record of it north of the tropic of Capricorn, viz., at the Herbert River, North Queensland, in 1910³.

In South Australia it has been reported in the far north at Lake Goyder, at Lyndhurst, and at other places, while it also occurs all along the River Murray, on the lakes at the Murray mouth, on the Coorong, in the south-east on most of the larger stretches of water, on Eyre Peninsula and the West Coast, and on Kangaroo Island.

Details of the specimen figured are: loc., Tailem Bend, S. Aust.; 24th August, 1938; total length 73 cm.; wing spread 96 cm.; weight 6 lb. 12 oz.; iris almost black; inside mouth flesh pink. Now mounted in the South Australian Museum.

(1) See "Emu," vol. I, p. 147 (C. G. Hamilton, Perth, W.A.).

(2) P.Z.S., Lond., 1882, p. 455.

(3) Broadbent, K., "Emu," 10, 1910, p. 233-245.

Land Shells from the Northern Flinders Range

By

BERNARD C. COTTON

Conchologist, South Australian Museum.

In October, 1938, H. M. Cooper collected some 3,000 dead land shells from the Northern Flinders Ranges, at fifty-one different sites. Although a search was made immediately after a fall of $2\frac{1}{2}$ inches of rain during this same month, great difficulty was

encountered in finding even half a dozen living specimens; bleached shells, however, were there in numbers about Blinman, even on the very tops of the ranges. E. Roberts, of Moolooloo South Station, reports that about twenty-five years ago, when there was still an

abundance of natural bush around Blinman, live native snails were so abundant after good seasons as to provide, on occasions, food for domestic fowls. F. W. Roberts, of Blinman, while obtaining slates for building purposes, noted about the same time large quantities of *Meracomelon* sheltering in crevices of rock in the Parachilna Pass.

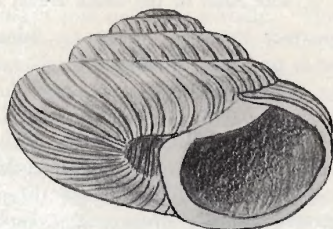
E. Pumpa, of Hawker, recalls ploughing up many native snails on his father's farm near that township some 40 years ago. A station hand now employed by Mr. French of Buckaringa, north of Quorn, states that years ago after a heavy rain on Yaddamalka Station, 50 miles north of Port Augusta, he saw numerous live snails moving about.

Old residents of the Blinman district state that in the past the bulk of rain fell in the

was in 1937, when 12.82 inches fell, but only 4.63 during April-September.

The extremely uncertain climatic conditions in this arid area and the consequent control effected on the ebb and flow of life generally is remarkable, yet understandable when one knows that, for example, a maximum of 21.53 inches fell in 1920, and only 4.47 inches in 1935, during the great drought. April-September figures varied between 10.46 inches in 1909 and only 1.84 inches in 1929. It appears that the land snails peculiar to this locality have suffered a severe setback from the drought years 1933-36 from which they have not yet recovered.

Since the above was written a further trip to this area was made under very different conditions during June, 1939.



A New Land Shell: *Pleuroxia cooperi*, sp. nov., from the Northern Flinders Ranges.

winter months, when almost every gully had running water, and soaks appeared on many hill sides. Rains and mists often occurred for several days in succession and conditions were therefore favorable to snail life.

On checking the rainfall statistics for this area we find that the average rainfall over seventy years is 11.65 inches, but varies greatly from year to year. It reached a maximum sixty-six years ago, in 1872, of 23.46 inches, and a minimum in 1935 of 4.47 inches. During the last fifteen years there has been a decidedly dry winter period. For instance, the total April-September rainfall for the three years 1934-1936 was two inches less than the amount for the corresponding period of 1909 alone. Furthermore, the average annual rainfall has only once been reached during the last sixteen years; that

Twelve inches of rain had fallen by June for 1939, which is more than fell during two whole years of the drought. Living specimens of all four species of land snails common to this area were taken in numbers, although prior to the rains they were almost impossible to locate alive.

The large number of living juvenile *Meracomelon meridionale suspectum* taken is significant. Prism Hill, a small outlier of the Northern Flinders Ranges, is located a few miles eastward of the ranges and five miles to the southward of Wertaloona Head Station. The hill, about 250 feet in height, is a razor back ridge, composed of loose outcrops of rocks with some scanty vegetation on the slopes and summit. At its foot runs the Moro Creek, a gum creek typical of these regions. This in turn enters Weetowie Creek,

and then into Lake Frome. A very small and isolated colony of *Pleuroxia cooperi*, sp. nov. exists (or existed) on the summit of Prism Hill. A prolonged examination produced only a dozen dead shells.

A third collecting trip to this area has now brought the total number of shells collected to 3,000 and the sites number 77, ranging from Port Augusta to Lyndhurst, and from Lake Torrens to Lake Frome. As many localities (some type localities) given for South Australian land snails are vague or inaccurate, a few of the more interesting species and localities for this area are given here. Heights above sea level are also given in some instances.

PLEUROXIA COOPERI

sp. nov.

Shell small, spire slightly elevated, depressedly subdiscoidal, umbilicus very wide, not hidden by reflected columella; radially coarsely, slightly irregularly ribbed, almost smooth except for a subordinate grained sculpture, axial ribs number forty on the body whorl.

Holotype. Summit of Prism Hill (250 feet above sea level), South Australia. Reg. No. D. 13765, S.A.M. Height 10 m., width 16 mm.

The species is nearest to *Pleuroxia arcigerens*, Tate, from Central Australia, but it is smoother, smaller, higher and more regularly axially sculptured.

The colony appears to have died out recently on the hill, which is an outlier of the North Flinders Ranges.

FAMILY VERTIGINIDAE.

Australbinula margaretae Cox.

Narrina Head Station, 1,500 feet. (One juvenile). Four miles south of Beltana. *Themapupa beltiana* Tate. Four miles south of Beltana.

Themapupa ischna Tate. Four miles south of Beltana.

Themapupa adelaidae Angas.

Four miles south of Beltana, numerous specimens. Oratunga Creek. One mile south-east of Quorn. Eleven miles north of Quorn. *Omegapilla australis* Angas. Four miles south of Beltana.

FAMILY SUCCINEIDAE.

Austrosuccinea australis Ferussac.

Ten Mile Creek, Wirrealpa. Parachilna Creek. Mount Chambers Gorge. Wirreanda Creek. Thirteen Mile Creek, 8 miles west of Blinman. It is reported by Mr. Bell, of Stokes Bay, Kangaroo Island, that this species is eaten there by domestic fowls.

FAMILY MICROCYSTIDAE.

Echonitor albumenoides Cox.

Slope of Mount Arden, 2,000 feet. Living shells are horn colored, not milky-white.

FAMILY HADRIDAE.

Meracomelon subloriolanum Pilsbry.

Warrens Gorge, 1,000 feet. Mount Arden.

Meracomelon loriolanum Pilsbry.

Port Augusta West. Specimens are very large, being up to 36 mm. in major diameter. *Meracomelon meridionale* Gude.

Four miles south of Blinman, 1,200 feet. Mount Mary, eleven miles west of Blinman. Nildottie Springs, 6 miles north-east of Blinman. Junction of Oratunga and Parachilna Creeks, about 9 miles east of Parachilna, 1,600 feet. Wonoka Creek, 5 miles north of Hawker. Eight miles south of Blinman. 1,700 feet. This species lives in colonies on the plains.

Meracomelon meridionale suspectum Iredale. Parachilna Creek Cliffs, 6 miles south-west of Blinman. Thirteen Mile Creek, 8 miles west of Blinman. Werta Creek, 12 miles west of Blinman, 1,300 feet. Between cliff ledges above creeks, never on the plains.

Meracomelon (Findomelon) luteofuscum Cox.

Mount Chambers Gorge, numerous specimens.

Meracomelon (Contramelon) howardi Angas.

Mount Chambers Gorge, numerous specimens.

FAMILY XANTHOMELONTIDAE

Sinumelon remissum Iredale.

Motpena, 9 miles east of Lake Torrens. Castle Creek, 7 miles north-west of Willochra, 800 feet. Brachina, 450 feet. Seven miles west of Parachilna, 400 feet. Edeowie, 400 feet. Lyndhurst, 450 feet. Puttapa Creek. Willochra.

Sinumelon godfreyi Iredale.

Woodendinna Springs, 8 miles north-east of Blinman. Limestone Springs, west of Lake

Frome. Wildowildina, 1,500 feet. Narrina Head Station, 1,500 feet. Emu Springs, west of Lake Frome. Wirrealpa. *Notobadistes flindersi* Angas. Ten miles south-east of Hesso. Two miles south-west of Port Augusta. Six miles north-west of Port Augusta. *Notobadistes aversum* Iredale. Two miles south-east of Blinman. Ten Mile Creek, Wirrealpa. Nildottie Springs, 6 miles

north-east of Blinman. Glass Springs, 4 miles north-west of Blinman. Third Waters, Oratunga Creek, 8 miles north-west of Blinman. Emu Springs. Rocky Water Hole, 3 miles south-east of Blinman. *Pleuroxia phillipsiana* Angas. Mount Painter (T. Harvey Johnston), numerous specimens. *Pleuroxia cooperi* Cotton. Prism Hill, 250 feet.

Some South Australian Water Plants

By

C. M. EARDLEY.

There is considerable variety in aquatic vegetation, it includes many true flowering plants, others related to ferns, besides a large group called *algae*; the majority of the seaweeds are algae, so are the filamentous, green pond slimes and scums and also a great many microscopic plants, composed only of a few cells, which inhabit fresh water.

It is the purpose of this article to concentrate attention on the aquatic flowering plants, so only a very few of the less advanced water plants will be mentioned. The first of these is *Chara* and the closely related genus *Nitella*, called *stoneworts* because their remains take part in the formation of freshwater limestone; the plants are able to do this by reason of the quantity of lime encrusting their cells. The calcareous, brittle character of *Chara* is very evident in the dried and bleached remains sometimes found at the edge of a drying pool in summer. Members of the *Characeae* are to be found in fresh and brackish waters all over the world, they are usually crisp-looking plants of a glassy green, having their stems with whorls of short branches at regular intervals. They appear to be related to the algae, but have a very unusual and complicated type of reproductive body, these may be seen as orange dots on the smaller branches. *Chara* or *Nitella* can be found in most ponds and creeks near Adelaide.

The ferns are a step higher in the plant world, and at least two genera of that group are quite common and familiar water plants,

though from their appearance, one would hardly suspect them of being related to the ferns. One of these is the Nardoo (*Marsilia*), whose leaves look rather like a large, four-leaved clover. Nardoo grows in claypans and lagoons in the drier regions of Australia, one of its chief characteristics is that of being able to grow to maturity very rapidly after a fall of rain; spores are produced in a small, brown sporocarp which has very hard walls and looks like a seed, these sporocarps are to be found in quantity in a dried-up claypan, and they are collected and ground by Aborigines to produce a kind of flour. When the sporocarps are slightly cracked and soaked in water, a jelly-like slime string is forced out of the hard coat, this is the beginning of the rapid life cycle.

The other fern ally so well known as a water plant is the Murray Duckweed (*Azolla*). It is a small floating plant made very conspicuous by its habit of occurring in large masses on the surface of quiet and sheltered waters; the individual plant is no bigger than a small coin and has a neat dense, branching structure with short roots hanging down below. The leaves overlap each other like scales, concealing the stem. The Murray Duckweed is either green or a beautiful red in color and, as one might expect from its common name, grows freely in the River Murray.

We now come logically to a consideration of some of the true aquatic flowering plants or aquatic *angiosperms*. The terrestrial habit is,



- 1—*Ruppia maritima*, L. Showing spring-like peduncles up to 12 in. long.
 2—*Potamogeton crispus*, L. Curly Pondweed.
 3—*Cymodocea antarctica* (Labill), Endl. Seedling with grapple of four comb-like lobes and young roots.
 4—*Halophila ovalis* (R. Br.) Hook, f. (Half size.)

- a—*Ruppia maritima*, L. Long, curved pollen grain (magnified), measuring 25 u. x 83 u.
 b—*Potamogeton crispus*, L. Rounded pollen grain (magnified), measuring 33 u. diam.
 c—*Potamogeton crispus*, L. Turion.

of course, the normal thing among the *angiosperms* and this mode of life is considered to indicate a more advanced phase of evolution than the aquatic habit which is characteristic of the algae, and from which the mosses and liverworts and ferns have not, or only partly, emerged. The hydrophilous nature of these interesting flowering plants is not a reversion to some ancestral form, but a further and quite distinct specialisation of an already highly developed race. Aquatic conditions are less exacting than terrestrial, but the complete change from one to the other must present a great problem in adjustment to the plant, in whichever direction it is made.

There is a truly hydrophilous group of *marine* flowering plants; presently we shall discuss some aquatic flowering plants which still preserve some of the characters of land plants, especially in their pollination, and are thus not hydrophilous. But these marine angiosperms, popularly lumped with the algae as "seaweeds," have become perfectly hydrophilous and live entirely under water, including pollination of the flowers as the term indicates. These plants are *Zostera*, *Cymodocea* and *Posidonia*, three genera of the family *Potamogetonaceae* and a fourth, *Halophila*, of the family *Hydrocharitaceae*. There are drawings of *Cymodocea* (fig. 3) and *Halophila* (fig. 4), the other two are grass-like in habit, *Zostera* is of comparatively fine growth, while *Posidonia* is the "seaweed" most commonly cast up along the Gulf beaches; it is a stout plant with ribbon-shaped leaves from $\frac{1}{4}$ inch to $\frac{1}{2}$ inch broad and often a yard long. These are green when growing, but more familiar in the papery, brown state of the heaps on the beaches. The leaf-bases remain on the lower parts of the stem in a fibrous mass; this marine *Posidonia* fibre has been deposited in a layer some distance below the soil along the north-eastern shores of the Gulf of St. Vincent and Spencer Gulf, it may be reached by boring at St. Kilda beach, north of Adelaide. There have been schemes to exploit this fibre for commercial purposes and it could be used, among other things, to replace jute to some extent. *Posidonia* is rooted in the sand like the other marine angiosperms, and it has bisexual flowers and filiform pollen.

Cymodocea has ribbon-like leaves of the *Posidonia* type, but only an inch or two in length. The flowers are enclosed in a leaf sheath and much reduced, they are unisexual with the males and females on different plants. How, then, is the pollen of the male flowers conveyed to the females? The pollen grain is known to be threadlike instead of globular and may be 2mm. long, a great length for a microscopic object. The stigmas also are threadlike and apparently succeed in catching some of the pollen after it has been discharged into the water, but probably only if conditions are fairly still. The seed thus formed seems to have no resting period, but germinates viviparously in the carpel on the plant; at this stage the endocarp enlarges into four horny petal-like structures which later become toothed at the end like a comb (fig. 3). The seedling plant is exactly like an ordinary leafy shoot growing from the centre of the four-lobed cup; eventually it breaks off from the parent plant, with the cup, which acts as a grapple to hold it firm among the sand while roots grow out between the lobes of the cup (fig. 3). For a long time botanists did not understand that there was a fertilised embryo involved in the production of this apparently vegetative shoot; it is opportune to mention here the contributions of two South Australians to the study of this plant, first, *Otto Tepper* at the end of last century and, more recently, *J. M. Black*, the author of the "Flora of South Australia."

Zostera, another important grassy plant of the littoral "sea-meadows," has the same subaquatic method of pollination as *Cymodocea*, but here the reduced male and female flowers occur in rows together in the one leaf sheath; one would think it a simple matter for pollination to occur inside this spathe, but no, that would be self-pollination, and it is effectively prevented by the ripening, emergence and falling of the styles *before* the anthers in the same spathe are ripe; therefore, cross pollination must occur.

Halophila (fig. 4), belongs to a different family, and is a plant of delicate texture and translucent leaves, seldom found except as rare fragments along the beach. The flowers are unisexual and pollinated under the water, the females have three filiform stigmas which

may be one inch long; the individual pollen grains are globular, but united into chains, so the effect is the same as in *Zostera* and *Cymodocea*.

It will only be possible here to say a little about three of the many fresh and brackish water plants. The first is *Ruppia maritima*, L. (fig. 1), a submerged, grass-like plant of cosmopolitan distribution, which has a remarkable toleration for variations in the salt content of its environment; it has been found in water containing as much as 12 per cent. total salts, this is about four times the amount in ordinary sea-water. The flowers of *Ruppia* are small and bisexual, the plant is found in still waters and the flowers are enabled to reach the surface by the growth of a long and delicate spirally coiled peduncle, sometimes of a pretty pink color. The pollen, which is boomerang-shaped in side view, (fig. a), is shed in quantity on the surface and floats about among the flowers, easily being caught by the stigmas.

Our species of *Althenia* are practically indistinguishable from *Ruppia* in the absence of flowers; these, however, are not on a long coiled peduncle, but concealed within a bract, they are unisexual and usually on separate plants; the pollen is globular and the pollination said to be subaquatic, which seems an unusual combination, in fact, the literature on the pollination of *Althenia* is very scanty. *Potamogeton crispus*, L., Curly Pondweed (fig. 2), sometimes makes itself a nuisance in the River Torrens, and is a familiar and widespread plant. The method of pollination is interesting when we remember that *Potamogeton* is still in the same family as the majority of the marine angiosperms, *Ruppia* and *Althenia*. In the *Potamogetons* the flowers are raised slightly above the surface on firm stalks, the pollen is globular (fig. b), and normal wind-pollination takes place. *Ruppia*, with floating pollination, is a half-way stage between this method and the entirely submerged one described for the other members of the family. *Potamogeton crispus* produces peculiar perennating structures called *turions*, they also occur in various forms in other water plants, those of the Curly Pondweed (fig. c) consist of a small part of the stem covered with closely set leaf

bases frilled and hardened; these turions are really resting winter buds which fall to the bottom of the pond, which may become frozen over, and produce new stems and leaves after winter.

The water plants mentioned in this article are all common in South Australia, but even so, their biology is imperfectly known, especially the reproductive phases of the marine ones for the study of which a good deal of perseverance is necessary.

It is a pleasure to express my thanks to Miss Christine Miller, who very kindly made the drawings illustrating this paper.

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Notes on the Ngaiawung Tribe, Murray River, South Australia

By

NORMAN B. TINDALE, B.Sc.

Ethnologist, South Australian Museum.

Mr. E. F. Boehm, of Sutherlands, South Australia, has forwarded some interesting notes on the aborigines of the Morgan district which he calls the "Kampoola Tribe." He has the record of a rock shelter fire, kept burning in winter; this is of special interest, and recalls to mind that when the Narangga natives of Yorke Peninsula lost their fire in winter and wood was too wet to ignite with the grass tree fire-sticks in use, they were under the necessity of sending across to the Birta people on the Murray River to ask for gifts of fire.

The Morgan horde or clan, or Kampu:la, is one of the series belonging to the Ngaiawung, or Aiawung tribe (often called Pitta, Pieta or Birta by their western neighbors). People



Woman and Child of the Murray River.



Murray River Man with Fighting Clubs.

of this tribe ranged along the Murray River from Herman Landing and Wongula in the south to just below Waikerie. Korkorana was the general name applied by the natives to the vicinity of Morgan, and Kulpu:la was a name applied to the lagoons and flats on the other side of the river. The hordes of this tribe, of which we have information, are:—

Murundi, at Moorundie.
 Aiaruk, north of Moorundie.
 Karmakalangbila, north of Blanchetown.
 Mulipaku, at Murbko.
 Kampu:la, near Morgan.
 Punkapareidke, east of Morgan.
 Karminwirra, north-west of Waikerie.
 Ulalpareidke, at Waikerie.
 Kababera, east of Waikerie.

The two last named clans may belong to the next up-river tribe.

tribe. It was recently (1935) reprinted by the late Mr. T. E. Parkhouse in his series, "*Reprints . . . Relating to the Autochthones of Australia, Part II.*"

Several early photographs have been brought to notice. They may serve to illustrate the foregoing remarks, although most of them were taken somewhat further downstream on the Murray River.

One figure shows a camp, probably at Kalpang, near Point McLeay. A duck net



Murray River Men with Pipeclay Decorations.

I have not previously heard the name Molo applied to any tribe or horde living to the east of Morgan. Among the tribes known were the Ngarkat (also called Buripung) in the mallee scrub country south of the river, the Ngawait (also called Ngawaijung) from above Boggy Flat and Penn's Reach to near Loxton, on the river, the Maraura in the dry country to the north and east of Lake Victoria and on the northern bank of the river, the Erawirung from near Loxton to the South Australian border on the southern or eastern bank, and the Ngintait between Salt Creek, N.S.W., and Ned's Corner, Victoria, chiefly on the southern bank of the Murray River.

The literature on the Ngaiawung tribe is scant. One of the earliest and rarest accounts is that of M. Moorhouse, entitled "*A Vocabulary of the Murray River Language*," Adelaide, 1846. The account was gathered at Moorundie and applies principally to this

tribe. It was recently (1935) reprinted by the late Mr. T. E. Parkhouse in his series, "*Reprints . . . Relating to the Autochthones of Australia, Part II.*"

Several early photographs have been brought to notice. They may serve to illustrate the foregoing remarks, although most of them were taken somewhat further downstream on the Murray River.

One figure shows a camp, probably at Kalpang, near Point McLeay. A duck net

is draped over the entrance to the hut, and one of the squatting women has a coiled rush-basket slung over her back. The man in the old skin cloak has fighting clubs in a special basket under his left arm. In his hands is a club for close hand-fighting, and a hardwood shield as defence. We also show an early studio photograph of a Lower Murray River woman wearing a skin rug. The two portraits are of Lower Murray River men, the former is of the Ramindjeri tribe at Encounter Bay, and the husband of the woman and child in the other picture. One of the few photographs extant showing the marks placed on the bodies of Murray River men as decorations for dances and ceremonies has also been reproduced. The pipe-clay designs run over foreheads, noses and parts of the beards, as well as around the eyes.



Camp Scene near Point McLeay.



Men of the Lower Murray: The one on the left belonged to the Ramindjeri tribe.

Notes on the Extinct Aborigines of the Morgan District, Murray River, South Australia

By
E. F. BOEHM.

While on a short stay in the Morgan district, Murray River, some time ago, I found some traces of the now extinct tribe of aborigines of the area, and an effort was made to discover as much about them as possible in the time available to me.

Very fragmentary skeletal remains were seen in several sandhills in the river valley, and one skeleton, in a fairly good state of preservation, was found in sandhills bordering the river valley at a point about two miles east-north-east of Morgan. This skeleton had been exposed by drifting of the sand. It was lying fully extended on an even plane (horizontal) with the legs pointing in an east-north-easterly direction. Examination of the skull, especially of the teeth and palate, the supraorbital ridges, and the receding frontal region left no doubt that the individual had been an Australian aboriginal.

On the sandhills of the river valley a small quartz knife-flake and a yellow sandstone hammer, exhibiting distinct signs of wear, were discovered.

An old resident of Morgan, who knew the last survivors of the local natives in person, and whose father had been acquainted with the tribe before it began to dwindle in numbers, informed me that the name of the Morgan "tribe" had been "Kampoola." The most influential individual had been a warrior called "Tannannabee." In

the earliest days there had been about six hundred people in the tribe.

A few miles up the river from Morgan, and a short distance towards Morgan from the junction of the Burra Creek with the Murray, there is, local residents told me, an aboriginal rock-shelter under the northern cliffs of the river, near where some derelict barges had been wrecked in more recent years. The natives called this place "Tanamee," meaning "never die." A fire is said to have been kept burning constantly (? in winter) here, and the spot was regarded as having certain magical properties.

I was informed that in the South Australian Museum there is the skull of a full-blooded Kampoola male, whose name had been "Cutmore Tommy." It was exhumed at the site of the present Morgan District Hospital. The tribe whose territory adjoined that of the Kampoola, upstream from Morgan, had been known as "Molo." On one occasion, a battle occurred between the Kampoola and the Molo people, and a notable Kampoola warrior was speared to death. He did not fall down immediately, however, but remained standing for a few moments after having been transfixed by the spear. The incident caused a stir at the time, for surely only a very brave and great fighter would remain standing when speared to death! Even to this day, the locality is known as "Nikalapko," or "Man Standing."

The Native Pheasant

In "What We Saw in Australia," by Rosamond and Florence Hill, 1875, we find an early record of this bird. The Misses Hill arrived in South Australia on April 7, 1873, and stayed with their aunt, Mrs. Clark, at Hazelwood. They made a trip to the "Lakes." "Our hostess, Mrs. Samuel Davenport, in her own carriage, accompanied by her sister, led the way, and E—— and ourselves followed in a travelling carriage of the country . . . The gentlemen came next day by the mail." At a camp out, the manager, Mr. Sandys, made a damper—whilst "Mr. Davenport was busy with a 'quart-pot'."

They speak of seeing "a nest of the native pheasant, a large dome-shaped mound made by dead leaves and sand, with four tunnel-entrances. When full it contains a very large number of eggs, which are hatched by the heat generated by the decaying leaves.

Numerous hen pheasants use one nest, and are said to be conducted thither by the cock when about to lay their eggs. The bird itself we never saw in the wild state."

(Tunnel-like entrances have never been noted by other observers to our knowledge.—Editor.)

Our National Park: Some Early History

By

GEORGE H. PITT

Archivist.

Before the passing of the Act of 1891, the Park was known as the Government Farm. The first man to occupy the land was a Nicholas Foott, who, although he paid no rent to the Government, was permitted to "squat" on the property on the understanding that, if it were sold, he would have to move at once. In spite of the insecurity of his tenure Foott put up a small wooden house, which had been imported in parts from England, added three or four stone rooms to it, and built stockyards, spending in all about £600 on these improvements.

In 1810 Governor Gawler decided to establish in the valley of the upper Sturt a farm where the horses and bullocks of the police, survey, and other departments could be put out to graze and where hay could be grown for the public service. He also had in mind the establishment of a "place of retirement within a short distance of the capital."

In July, 1840, Foott received notice to quit, but he was allowed £300 for his improvements.

The manner in which the Government obtained possession of the land was not strictly in accordance with the practice prescribed by law, and doubts soon arose about the validity of its title. The Government could not obtain the property simply by proclaiming it a public reserve, for under the Act of 1834 it was only permitted to make reserves for roads and footpaths, and with this exception all lands were to be open for purchase by British subjects. Land sales were controlled by the Resident Commissioner, the local representative of the Colonisation Commissioners for South Australia, in whom all the lands in the province were vested; and the Government, if it wanted land, was in precisely the same position as any private party. It is true that Colonel Gawler was both Governor and Resident Commissioner, so that it was possible to observe the forms of law while reducing the transaction to a mere matter of bookkeeping, the sale price being debited to general revenue and

credited to the Land Fund. Nevertheless, under the Act of 1834, all sales were to be in public and for ready money, and in the purchase of the Government Farm these conditions were not observed. On July 22, 1840, the Government, through the Colonial Secretary, formally applied by letter for ten sections (Nos. 819 to 828) in the valley of the upper Sturt, containing in all 800 acres. The purchase price was £800, but no money actually passed, for the Colonial Secretary merely tendered his own personal promissory note, which he was not called upon to honor.

Although the position was ultimately regularised by the payment of £800, for a year or two the Government's title was rendered questionable by the violation of the statutory requirements of open tender and public sale for cash.

There was a further irregularity in the fact that, although the Colonial Secretary applied for ten sections, thirteen were actually conveyed, and the farm was informally increased by the addition of 1,108 acres of unsurveyed land and several valleys running into the property. Thus its area was at first, not 800 acres, but 2,148 acres.

Upon the dispossession of Foott, the Government appointed John McLaren superintendent of the farm, and spent £577 on fencing. According to an official description of the place in December, 1840, about a thousand acres had by that time been enclosed with a post and rail fence, and the other improvements consisted of Foott's wooden house with its stone additions, some out-houses, a stockyard, and a well.

When Governor Grey arrived in May, 1841, he at once began to cut down Government expenditure, and he had hopes of raising a few hundred pounds by selling the farm. In a despatch, dated May 21, 1841, after describing the colony's desperate plight and discussing ways and means, he said, "The sale of the Government Farm, and Government horses, and other property of this description

would appear to be the readiest means of providing the necessary funds. . . . The Government Farm is by no means a necessary appendage to the province." "In the present distressed state of the money market," he added, "it would be difficult to find purchasers, and the property, if the sale were now pressed, would not probably realise more than half of its actual value. The difficulty may be avoided by negotiating a loan at one of the banks and offering the Government Farm as a security for the repayment of the loan. From time to time advantage may be taken of favorable opportunities, and portions of the property may be sold."

On July 15, 1841, it was announced in the Government Gazette that the farm would be sold by auction on July 19. It was described as a "splendid farm of about 1,500 acres of the richest land in the province." But the sale was apparently cancelled, for it was feared that, for the reasons given above, the Government's title was defective.

During the depression of 1841-2 several of the unemployed settled with their families on the farm, enclosing small areas and growing vegetables on them. There were in all about a dozen families, and, although warned not to expect any fixity of tenure, they were permitted during the hard times to remain in occupation. Among those who were "squatting" on the farm in this way in 1842 were the following:—Henry Bacon, John Pearce, James Pearce, John Downing, John Wecombe, and Zebulon Batt.

In June, 1844, the area of the farm was reduced by about 400 acres by the sale of five sections at the western end (Nos. 874, 875, 878, 879, and 882).

In 1848 a small cottage was erected at a cost of £100, as a residence for the keeper of the farm and also for the occasional use of the Governor. The old house erected by Foott had become dilapidated, and in 1844 Keeper R. H. Moulton had reported that the ceilings of three rooms were in imminent danger of falling in and that a storm had stripped some of the tarpaulins from the roof of the wooden portion.

In the following year tenders were invited for the lease of the farm for a period of seven years. The buildings then standing were the new Keeper's house and Foott's old

wooden cottage, with stone kitchen and three other small rooms attached. William O'Hara's offer to take the property at £266 a year was accepted, but he appears to have failed to fulfil the conditions of the lease, for tenders were again invited in October, 1851. A second lessee was found, but he too was unsatisfactory, and in May, 1852, tenders were invited for a third time, on this occasion for a period of one year only. The advertisement met with no response, and Governor Young gave orders for the Commissioner of Police to take charge of the farm for the use of horses employed in the gold escort and other police services.

In 1856 a coach-house and stables were added to the buildings on the farm, and in the following year, at the request of the Governor, Sir Richard MacDonnell, a pigeon-house was erected and a gate was substituted for the slip panel at the entrance to the property. Foott's wooden house was still standing at this time, and £90 was spent in repairing it.

In 1858 it was decided to build a "cottage residence for the Governor" on the farm, and at the end of the year a contract was let to C. Farr. This building, which was completed before July, 1860, cost about £1,600, and is still standing (1939). It was provided with a swimming pool, fed by two springs which, though close together, were of very different natures, one being heavily impregnated with salts, while the other yielded pure, clear water.

The house erected in 1859-60 was used as a summer resort by Sir Richard MacDonnell, Sir Dominick Daly, and (until the erection of the house at Marble Hill) by Sir William Jervois. It was too small for Sir James Fergusson, who preferred a residence rented by him at Robe, but lent the house at the farm to his brother, Major John Adam Fergusson, who occupied it for a time after his marriage in the early eighteen-seventies. In 1939 the house is called "The Rest," and is occupied by the Curator of the Government Nursery. The building erected in 1848 and those put up by Foott have long since passed out of existence.

In the late seventies large quantities of carbon bisulphide were manufactured at the farm under the direction of the Surveyor-General,

for sale to pastoralists for the killing of rabbits.

In 1881 a proposal by the Government to sell the farm in small allotments aroused a strong protest in the public press. The late Mr. Walter Gooch was especially active in condemning the proposal, and he was supported by the Australian Natives' Association and, later, by the Field Naturalists' Section of the Royal Society of South Australia. A memorial, bearing many influential signatures, was presented to the Commissioner of Crown Lands on January 10, 1882, protesting against the disposal of the farm and recommending its retention as "a water reserve, an experimental farm, a forest reserve, an acclimatisation station, and a national recreation ground." At this time the hills railway was being constructed, and it was expected that, when completed, it would provide the necessary transport for thousands of holiday-makers. This strong expression of public opinion not only prevented the proposed subdivision of the farm, but led to the passing of an Act in October, 1883, prohibiting its sale without the sanction of Parliament.

On August 5, 1890, the Premier stated that his Government approved of the reservation of the farm as a national park, but a change of Ministry occurred a few days later. In order to accelerate matters a Bill for constituting the farm a national park was prepared

by the Town Clerk of Adelaide under instructions from the City Corporation, acting in concert with the Native Fauna and Flora Protection Committee, but on November 5, 1890, the President of the Legislative Council ruled the Bill out of order. The efforts of all who had worked for the conversion of the farm into a public recreation reserve were crowned with success on December 19, 1891, when the National Park Act received the Governor's assent. The first Board of Commissioners was appointed on January 19, 1892, and consisted of the following members: Sir Edwin Smith, Alexander McDonald, Walter Gooch, Joseph C. F. Johnson, Samuel Dixon, and the following ex officio members: The Commissioner of Crown Lands (Thomas Playford), the Mayor of Adelaide (F. W. Bullock), the Conservator of Forests (W. Gill), the Director of the Botanic Gardens (Dr. M. W. Holtze), the Director of the Zoological Gardens (R. E. Minchin), the President of the Royal Society (Rev. T. Blackburn), and the President of the Agricultural Society (J. L. Stirling).

The Board held its first meeting on January 28, 1892, and it appointed its first Curator and Secretary (W. H. Sanders) on May 18, 1892.

(Prepared at the request of the Chairman of the Commissioners of the National Park.)

The Platypus in South Australia ?

Professor Wood Jones states that "The Platypus at the present time is distinctly an eastern Australian and a Tasmanian animal, and Bennett did not believe that it existed in South Australia. Its inclusion in the fauna of South Australia is, however, quite correct even at the present day. From some of its old haunts it has disappeared. Nevertheless it still occurs within the limits of our State, and from its inobtrusive habits it is possible that it may even linger in some places where its presence has escaped notice." The Misses Rosamond and Florence Hill in their book, "What We Saw in Australia," 1875, p. 57, remark: "Hahndorf, through which we drove, is a settlement of Germans, and might be taken for a village in the Black Forest, so

closely are the characteristics of the 'Waterland' reproduced in the build of the houses, and of the long, narrow waggons, and in the aspect of the people. Soon after we crossed the pretty Onkaparinga, on whose banks was shot, while we were in the colony, a specimen of the almost extinct Ornithorhynchus. Surely it is a pity to destroy, as the curiosity-hunters will soon do if they continue to kill every individual discovered, this interesting link between different classes of animals, to say nothing of depriving a harmless little creature of the happiness of existence!"

The Misses Hill arrived in South Australia on April 7, 1873, and left again in January, 1874.

The Field Naturalists' Section

EXCURSIONS

1940			
Jan. 20—Outer Harbor	Train, 1.10 p.m.	Live Shells	Mrs. G. Edmeades
29—Tailm Bend (9 a.m.)	Motor (5/-)	Lagoon Life	Mr. B. C. Cotton
Feb. 3—Flinders, St., Kent Town	Tram, 2 p.m.	Aquaria	Mr. P. A. Geisler
10—Marino	Train, 1.11 p.m.	Loricates	Mr. W. M. Nielsen
24—Hallett's Cove (1.30 p.m.)	Motor (2/6)	Geology	Miss W. M. Warhurst
Mar. 9—Port River (Launch 2/6)	Train, 1.10 p.m.	Dredging	Mr. F. K. Godfrey
16—Mt. Lofty	Train, 1.14 p.m.	Flower Show	Mr. A. J. Morison
23—25—Goolwa Easter Camp	Train	General	To be arranged
Apr. 6—Botanic Gardens	Gates, 2 p.m.	Nurseries	Mr. H. Greaves
13—Onkaparinga Gorge (1.30)	Motor (2/6)	Observoranda	Miss D. M. Matthews
25—Williamstown (9 a.m.)	Motor (4/6)	Warren Reservoir	Mrs. P. Filsell
May 4—Grange	Train, 1.40 p.m.	Sand Hill Flora	Miss C. Eardley
11—Outer Harbor South	Train, 1.10 p.m.	Malacology	Mr. F. K. Godfrey
25—Morialta	Tram, 2 p.m.	Ecology of Res.	Prof. J. B. Cleland
June 1—Museum	Entrance, 2 p.m.	Lecturettes	Various
10—Roseworthy College, 9 a.m.	Motor (4/6)	Agriculture	Dr. A. R. Callaghan
15—Henley to Glenelg	Tram, 1.30 p.m.	Intertidal Life	Mr. G. Pattison
29—National Park	Train, 1.14 p.m.	Foliage	Mr. E. H. Ising
July 13—Semaphore to Grange	Train, 1.10 p.m.	Marine Life	Miss D. M. Matthews
23—Zoological Gardens	Gates, 2 p.m.	Zoology	Mr. R. R. Minchin
Aug. 3—Anstey's Hill (1.45 p.m.)	Motor (3/-)	Physiography	Dr. C. Fenner
10—Outer Harbor	Train, 1.10 p.m.	Mud Flat Life	Mrs. L. E. Elliott
24—Black Hill (1.45 p.m.)	Motor (1/9)	Foothills Flora	Mr. W. A. Stow
31—Kingston Park Reserve	Train, 1.11 p.m.	Shrubs & Plants	Prof. J. B. Cleland

TRAM EXCURSIONS.—Meet in Grenfell Street by T. & G. Building.

TRAIN EXCURSIONS.—Will members obtain their tickets and meet on the train.

MOTOR EXCURSIONS.—Meet at the Town Hall, Adelaide. Bookings close with the Secretary or the Treasurer three days before excursion, and seats will be allotted in order of priority.

EVENING MEETINGS

1940.		June 18—The Malacological Society Evening.		
Feb. 20—Conversazione	Mr. L. A. Elliott	Chairman	Mrs. L. E. Elliott	
	"Colored Travelogue Films."			
Mar. 19—"Bird Lore"	Mr. R. R. Minchin	July 16—Microscope Evening	Mr. J. D. O. Wilson	
			"The Micro Lepidoptera."	
Apr. 16—"The Simpson Desert" ..	Dr. C. T. Madigan	Aug. 20—Annual Meeting.		
			"How Soils Determine the Distribution of	
May 21—"The Aborigines"	Mr. N. B. Tindale		Plant Life"	Prof. J. A. Prescott

MALACOLOGICAL SOCIETY: Evening Meetings

1940.		20—West Coast Shells	Mr. W. G. Tucker
Mar. 4—Acanthochiton Species, Rev. B. J. Weeding		June 3—Anthochiton Species, Mr. W. M. Nielsen	
18—1 Marden Road, Marden, Mrs. L. E. Elliott		17—Shells Studies	Mrs. G. Edmeades
Apr. 1—Sea Stars	Mr. F. K. Godfrey	July 1—Life of the Ocean, Miss D. M. Matthews	
15—Evolution of the Mollusca, Miss W. M. Warhurst		15—Apertures of Gastropods, Mr. F. K. Godfrey	
May 6—Common Minute Gastropods, Mr. B. C. Cotton		Aug. 5—Annual Meeting	Exhibit Night
		19—Some Attractive Foreign Shells, Mr. W. Tucker	

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(Out of print.)

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by

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VOLUME 20, No. 2.

MAY 15, 1940.

Registered at the G.P.O.,
Adelaide, for transmission
through the post as a
periodical.

The South Australian NATURALIST

JOURNAL OF THE FIELD NATURALISTS' SECTION OF THE
ROYAL SOCIETY OF SOUTH AUSTRALIA.

Price: One Shilling.

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THIS Section was founded in 1883 for the purpose of affording observers and lovers of Natural History regular and frequent opportunities for discussing those special subjects in which they are naturally interested; for the Exhibition of Specimens; and for promoting Observations in the Field by means of Excursions to various collecting grounds around the Metropolis.

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The Living Bird

By

OSCAR SYMON AND H. T. CONDON.

The astonishing progress made by ornithology in Europe and America during the last twenty years has been mainly due to, and is increasingly dependent upon, the study of the living bird in its natural surroundings rather than of the feathered corpse in laboratories and museums.

In these two continents are tens of thousands of birdwatchers who, mostly working on organised and co-operative lines, are not only enriching our knowledge of birds and so contributing to science, but also helping to ensure the permanence of one of the organic resources upon which civilisation is dependent.

AUSTRALIA NEEDS BIRDWATCHERS.

Australian ornithology to-day evidently stands where European and American ornithology stood fifty years ago.

Here, in Australia the science of birdwatching is hardly recognised as such; here, we mostly remain unappreciative and passive in the light of the successes and failures of modern birdwatching as practised in other countries; here, organised and co-operative birdwatching is still unknown; here, purposeful and persistent birdwatchers number a few hundred at most; and here, for instance, exists nothing like a complete life-history of a single species, much less of an individual bird or pair of birds, of any of the birds which may be found in Australia.

Australia urgently needs birdwatchers, thousands of them!

To help meet this need by promoting a better understanding of what birdwatching means and how to go about it is the main reason for this article, which has been illustrated after the modern way of educational illustration of birds used especially by the National Association of Audubon Societies of America.

The second is that modern birdwatching offers practically a new field of service for Australians—to people in all walks of life and of any age, to field naturalists, professional and amateur natural scientists of all kinds, teachers in schools and colleges, scoutmasters, girl guides, field officers of the Agricultural, Forestry and Waterworks De-

partments, harbor masters and light keepers, and to agricultural colleges, experimental farms, research stations and institutes, and to universities.

And, the third, because birdwatching is not only a healthy, inexpensive, interesting and entertaining hobby or pursuit full of endless pleasures and surprising rewards, but because the results of birdwatching are indispensable material for ornithology in particular and for science in general.

WHAT BIRDWATCHING MEANS.

Birdwatching is the objective, accurate observation, with or without the aid of scientific equipment and technique, and the honest noting down on the spot of all the facts of the everyday life of free, wild birds in their natural or artificial haunts, either as a species, or as individuals, or as both in relation to their environments, and the subsequent methodical and permanent recording of all such facts for the information of any appropriate scientific body or museum and, through them, for birdwatchers everywhere.

This explanation may or may not be suggestive of the acknowledged fact that birdwatching is "either the most sporting of sciences or the most scientific of sports." One of which, according to the spirit in which it is taken up and followed as a hobby or pursuit, birdwatching surely is. But it does imply that if you really desire to become a birdwatcher of greater or lesser parts, and contribute to the sum total of man's knowledge of birds, you cannot regard birds either as interesting, mostly misshapen, mummified things in a museum, or as captives in aviaries or, and most important, merely as an agreeable but vague part of the general background of life in your garden, in the country or on the seashore.

WHO CAN BE A BIRDWATCHER.

You don't have to be an ornithologist, or any other sort of "ologist" to become a birdwatcher.

Some of the most outstanding contributions to ornithology, as is also the case with other natural sciences, have been made by men



Willie Wagtail



Restless Flycatcher



Magpie Lark - male



Magpie Lark - female



Bronze Cuckoo or "See You"



Blue Wren



Black-capped Sittella



Brown Treecreeper



Yellow-winged Honeyeater



Crescent Honeyeater



White-plumed Honeyeater or Greenie



White-naped Honeyeater



Welcome Swallow



Fairy Martin



White-backed Swallow



Fork-tailed Swift



Blackbird



Starling



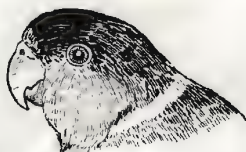
Indian Dove



House Sparrow - male



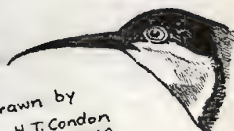
Black Cockatoo in flight



Ringneck Parrot



Grey Butcher-bird



Drawn by
H.T. Condon
1940

Eastern Spinebill



Whistling Eagle



Wedge-tailed Eagle



Swamp Harrier



Black-shouldered Kite



Nankeen Kestrel



Musk Duck



White-eyed Duck



Manded Goose



Pink-eared Duck



Grey Teal



Freckled Duck



Black Duck



Crested Grebe



Crested Tern



Silver Gull



Little Grebe



Hoary-headed Grebe



Coot



Pied Cormorant in flight



Immature above, flying



Sacred Kingfisher



Azure Kingfisher



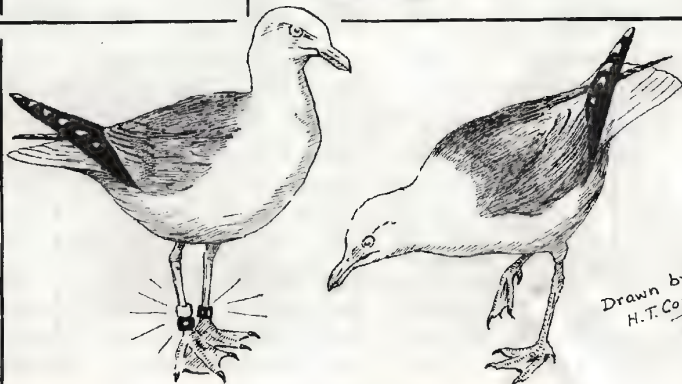
Pied Cormorant



Pacific Gull



White-headed Stilt



(after R.T. Peterson in "Bird Lore")



White Ibis

Drawn by
H.T. Condon
1940

and women who never had any scientific training whatever. They started watching birds because they felt, and very rightly too, that wild birds were worth watching and getting to know better for their own sakes. The object of their birdwatching was to have for their own information and delectation experiences with birds, to see exactly what birds did and how they did it, and to hear what birds said and how they said it. Moreover, as part of the game, these bird-watchers jotted down their observations on the spot, using any piece of paper or any sort of notebook, and then, after returning home they found additional pleasure in the methodical and systematic transcription of the field-notes into diaries, thus providing themselves with permanent records and reference books of the everyday activities and peculiar manners of the birds which they encountered.

True it is that such people were possessed of an inquiring mind, a love of stalking wild animals, an intelligent patience, listening ears, and seeing eyes, strengthened more often than not, with opera glasses or binoculars. But what field naturalist does not possess these faculties or what normal and bird-loving layman cannot develop them to a greater or less degree?

Birdwatching is open to all—man or woman, young or old, rich or poor. Anybody, in whom is a desire to know wild birds better and have experiences with them, and in whom is the little energy required to unbridle that desire, may easily become a bird-watcher. Once started, the persistent novice, carried along by the natural momentum of the thing, will soon be not only experiencing the endless pleasures denied non-bird-watchers, but also asking him or herself and others, in person and in books, "why" and "how" questions about birds and their habits and behaviour. And, because of this inquiry and thirst for greater knowledge of birds the novice is surely blossoming into a scientific birdwatcher.

As to the cost of birdwatching. It need not cost a penny for gear or anything else. Contrary to the general belief, birdwatching means neither travelling all over the country nor tearing from one particular haunt or "good place for birds" to another, just seeking to "list" birds or see birds alleged to be rare. Better to stay at home or in one locality and write a simple and accurate biography of any of the common birds, say

the Silver Eye that nested in your garden, that cleaned up the aphids on the rose bushes last winter and is now messing up the grapes. Remember it is easier always to study the common bird than the rare.

HOW TO BEGIN BIRDWATCHING.

The art of birdwatching includes, it has been well said, the ability to make the most of different environments, whether reckoned as "good" or "bad" places for birds, whether humdrum or unusual.

The best place to begin birdwatching is about the home or farmstead, about the school-house, or in a city square or park, say during the lunch hour. Your interest aroused, not only these places but also, when visited, the sea beaches and countryside will become alive to you in a new delightful way. But as birdwatching absolutely depends on correct sight identification the first thing to know is how to identify birds.

There are three ways. To follow all simultaneously is best, but any one of them will serve. First ask someone who really knows birds both to name on the spot those in your locality and to take you out birdwatching; the second, visit museums whenever possible and seek out the ornithologist, who will be glad to meet you and to let you handle the stuffed skins of all kinds of birds and otherwise help you; third, at the Public Library study all the good and well illustrated books about birds, as well as the periodical, and other publications by ornithological societies and scientific bodies. If you care to, buy a pocket-size book which will help a great deal in the identification of Australian birds, buy the one by Leach, and for preference any edition but the last.

BIRD IDENTIFICATION FACTORS.

Identification looms large in birdwatching. It is the rock upon which all reliable birdwatching is built, both by the expert and the less expert. Hesitant at first, the beginner will learn to instantly and almost unconsciously recognise all the birds regularly seen.

However, at the outset and like all other birdwatchers ever born, the beginner will more or less successfully try to identify birds by concentrating on their plumage and size. Then, as familiarity increases, will come a realization that quick and accurate identification depends on a knowledge of not only one factor but several, the importance of any

or all of which depends on the observer and the circumstances. These factors are:—

1. Build.
2. Carriage, or action in flight, or both.
3. Size.
4. Plumage, particularly any distinctive tribal marks.
5. Color of soft parts, certainly bill and feet.
6. Call and song, if any.
7. Habitat and season.
8. Known habits.

The accompanying pictures satisfactorily illustrate factors 1, 2, 3, 4. As to factor 5, one kind of adult tern has a yellow bill and black legs, another kind has a red bill and black legs, and another kind a black bill and black legs, etc., so colors of "soft parts" are of no little importance; by the same token, the cock black-bird has a golden bill, the hen a greyish-black one. Factor 6: The importance of training the ear to recognise the calls and peculiar voices and song, if any, of birds cannot be emphasised too strongly. It permits unseen birds to be identified and as often as not, birds are heard before they are seen. For instance the bird which sings out, "Pee-Wee" or "Jean - Jean - Jean - or-whit-or-whit-or-whit," does not have to be seen to be identified as the Magpie Lark, if its language is known. And a knowledge of bird calls permits the identification, etc., of nocturnal birds and night-active birds—the subdued, nasal talk of black swans in flight; the quacks and squackerings peculiar to the different kinds of ducks as they feed at night; the boom of a bittern or the "more-pork" of the boobook owl. Factors 7 and 8: Knowledge of these factors is gained both from reading good books and literature on birds and from personal field experience, the details of which must be transcribed from field note books into permanent records, both for your own information and reference purposes and for that of other birdwatchers and scientists.

IDENTIFYING THE UNKNOWN BIRD.

When an unknown bird is seen, the best course to take is to get as close to it as you can and secure as many details as possible about it, and from which it may be identified later on. This means skilful, patient and often disagreeable stalking, and preferably with the aid of good binoculars. With the bird under closest scrutiny, note down what it looks like, what it does, an impression of

anything it says, whether it was a solitary bird or with others of its own kind or of another kind, where and when it was seen—anything which may help to establish its identity. Afterwards consult books and other birdwatchers or museum people to determine, if possible, the bird's identity. Don't be disheartened if it is revealed that the particular bird has been often recorded in that district, for *locality* where seen is more important to ornithology than *district* where seen. Besides some activity or piece of behaviour by the bird in question may never have been witnessed before by any other birdwatcher.

Birdwatching has no rules, but the beginner must understand from the start that:—

1. The person who can immediately identify in the field every bird seen is not an expert birdwatcher but a charlatan.
2. Birds don't have to be shot to be identified. Purposeless bird-skin collectors, whose childish acquisitiveness is only equalled by that of collectors of eggs, say it is necessary. Don't believe them.
3. No sight record of a bird is worthless. It may be wrong, utterly wrong. But if it is humbly claimed it is worth investigation; and, what is more, birdwatchers, like other people, learn from mistakes as well as successes. Nevertheless, be careful always, and so avoid recording Cassowaries near the Coorong or Regent Bower Birds at the Burra.
4. Even the most successful scientific birdwatchers have first approached birdwatching in a haphazard way. This manner of approach is one of the peculiarities of the science of birdwatching, and is often ignorantly called "amateur" or "dilettante." Birdwatching is becoming more and more professionalised as a science in other countries.

WHY WATCH BIRDS.

Birds are one of the few groups of animals which on the whole are useful to man. Their place in Nature, and in the economy of things generally, is at least of equal importance to that of all other forms of wild life. The results, therefore, of birdwatching, are indispensable to science.

Specially valuable, as Huxley says, for two branches of science. First, the study of the behaviour and mind of animals—"the evolution of mind, that strange and mysterious property of living creatures with which the present scientific scheme of things, coherent though it be, is still very incompletely linked up." Second, the study of the relations of living things with each other and their environment, called ecology or scientific natural history—"a branch of biology destined to play a large practical part in human affairs." A common example of bird psychology is the mobbing of cuckoos, hawks and owls by small birds; another, the extraordinary gift possessed by some species in their natural state for mimicry of the calls or songs of other birds—the Lyre Bird for instance, while the vulgar Starling is a lesser master. What is the utility of such mimicry? Why do some species, and not others, possess the gift? Why does one bird practice it in its natural surroundings, and others, like cockatoos, parrots, magpies, only when taught?

Some interesting light was thrown on bird behaviour and psychology by the results of the following experiment in America. Stuffed birds, made as lifelike as possible, were placed in the open near wild birds with the unexpected result that the male wild birds came and fought the stuffed ones. Male wild birds of one species mistook stuffed males for living females of their own species. Some wild birds, in which the plumage of male and female is very different, were able to distinguish the stuffed female of their own species. But on the whole, the results showed that, in all probability, the males of many species of birds are unable to tell their females at sight.

Bird ecology is a virgin field in Australia. Its application is essential in order to discover precisely how, in any given locality, birds live in community with their own and other species of birds, and how their lives are nourished and activated and their ways of living influenced by all the other living things living in community with them.

Bird ecology provides field naturalists with a great opportunity. For, in addition to a good knowledge of birds, there is also required a knowledge of enough botany to name the common plants and trees among which the birds live, enough entomology to recognise the insects on which the birds feed, and so on with each branch of natural

history that has a possible relationship to the environment of the bird.

Birds must also be watched to learn exactly all their habits and behaviour—their life histories. And, ever since modern bird-watching established the fact that *birds are not automatons but individuals, each with its own personality and temperament, its own personal problems and solutions within the species pattern*, science has demanded individual life histories, instead of the former general character studies and life histories of different species of birds.

Since this recognition by science of the basic importance of the individual bird, European and American ornithology has been vastly enriched by the observations and investigations of birdwatchers who, with acute selectivity of objects, have watched, and are watching, literally millions of individual birds of many different species. The chief method is called "Bird Banding," which consists of securing, in various combinations, differently colored and numbered rings around the legs of birds, either when they are nestlings or when caught later on in life in traps. Thus individual identification is satisfactorily maintained and, according to the species and the object in view, the same individuals may be accurately observed daily for years.

Bird banding methods are used to throw light on all sides of bird life. For example, in a large American orchard were put up numerous nest-boxes most of which were occupied by pairs of house-wrens. At night the pairs in the boxes were caught and banded. These birds always have at least two broods in the nesting season; so, after the first brood had been raised and left home and the second brood was about halfway through its nursery period, all the adult wrens were caught one night and examined again. The result was surprising, for it was discovered that about eighty per cent. of them had changed partners between broods. Again, for instance, it was demonstrated in England that Ring Plovers are color blind, have no ordinary sense of smell, and cannot recognise their own eggs. Further, as an example of the value of banding in learning about migration, or the partial migration of birds, a Tufted Duck, on a reservoir near London, was banded in January, 1934. In January, 1935, it was caught on the same reservoir. On April 25, 1935, it was reported from Finland.

Bird banding has yet to be applied in Australia, although Dr. Serventy is now trying to get it organised and started along the co-operative lines so successfully followed in other countries.

Bird protection and bird black-listing laws have been termed dated farces based mostly on ignorance, personal opinion and prejudice, both local and general. Substantially true! Bird laws satisfactory to both birds and man can only be framed on a scientific basis. And the only way to prevent "ignorance, personal opinion and prejudice" from detrimentally affecting the issue is to carefully weigh the pros and cons of the correlated results of the observations and investigations of not a few, but hundreds of birdwatchers and ornithologists. All the more so because a bird may be a pest in one locality and not in another, and only birdwatchers can properly define these localities, and compute bird numbers without resort to the vague terms of "rare," "common," "very plentiful," or "as thick as flies and as bad." *Birdwatchers can do a very great deal to secure just bird laws.*

It is well to destroy pests, just as it is well to remember that no bird is altogether bad. Some birds considerably damage fruit, crops, fish, and lambs and ewes. But a carefully planned scientific investigation of the whole

matter over a number of years might, as likely as not, prove that the damage claimed to have been done was made good, perhaps outweighed, by these same birds, in their endless destruction of creatures and organic matter much more pestiferous and harmful to man's fruit and other things—for instance, grasshoppers, locusts, caterpillars, grubs, aphids; fish, crabs and shell-fish, and the rest which gorge on the spawn and fry of edible fish; the carrion from which come blowflies, the eggs and larvae of nasty worms and flies in the droppings of sheep, cows and horses, or the water-snail that harbors the sheep-fluke. Other birds, which are enormously beneficial to man, appear to be altogether good.

Nevertheless, the more both kinds of birds are observed the more it is realised that most Australian birds, like most men and women, are half saint and half devil. And, because we are still a very long way from knowing "Why" and "How," "When" or "What to do about it," the field for organised birdwatching in Australia is an extremely wide one. A field inhabited by a great many different kinds of wonderful, and not a few unique, birds all of whom are fairly singing out for more and more birdwatchers to get to know and study each one of them as an individual, living bird.

Yellow Gilled Toadstool

AMANITA OCHROPHYLLA.

The Ochre-gilled Amanita figured on the cover belongs to a genus of fungi which contains amongst its species some of the largest, some of the most handsome and brilliant, and some of the most poisonous of the toadstools. The Amanitas can be recognised by their white spores, by the gills being usually white or light in colour, by the presence of a ring on the stem, by a more or less evident volva or cup at the base of the stem which may disappear at maturity or be represented merely by a fringe or line on the bulbous base, and by the stem being readily remov-

able from the cap. *A. ochrophylla* is one of our largest species, the cap at times reaching a diameter of nearly nine inches. It is not common in this State, but has been recorded from the Greenhill Road, Mount Lofty, Kuitpo, Square Waterhole, Willunga Hill and Waitpinga. In Sydney it may be found in the sandy soil round the Harbour in autumn after heavy rains. It has rather a strong smell, which itself would deter anyone from tasting it, so that it is not known whether it is poisonous or not.

MISTLETOE.

The Flora and Fauna Committee in its drive to eradicate Mistletoe has learned from the Director of the Botanic Gardens that trees affected by this parasite in the Gardens have been cleared of it.

It is interesting to record that *Lagunaria*, *Pittosporum undulatum* and English Ash

were the trees from which the Mistletoe was removed. H. M. Hale has a photograph showing Mistletoe growing on the introduced Argentine Tobacco (*Nicotiana glauca*), in the Flinders Ranges, South Australia. It also infests the common edible fig, at times very badly.

A Curious Arrangement of Sticks Near Lyndoch, South Australia

By

NORMAN B. TINDALE, B.Sc.

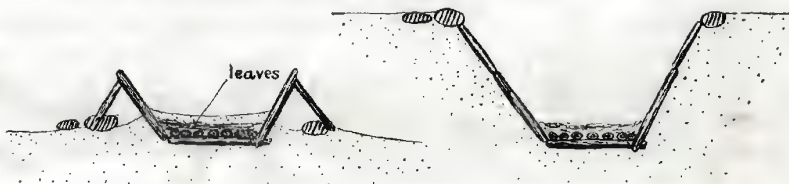
Ethnologist, S.A. Museum.

In company with Mr. H. L. Sheard, the writer went to a former campsite of the aborigines on a sandy hill behind the golf links, a mile from Lyndoch, South Australia. This is a site of the type beloved of the natives, for there is a view in every direction, as well as a wide prospect across the valley of the Para River.

We found a curious circular arrangement of weathered sticks situated on an area of sand, which, quite recently had been wind-blown to a depth of about three feet. They were in a closely spaced series, each stick about eighteen inches long, standing slantwise in the ground, in a circle. A series of loose ones were resting on them on the outside of the circle. It was evident after testing by a partial excavation, that before erosion it

had been a round pit, filled with sand, smaller in diameter at the bottom than at the top. When newly made it had been floored with crossed sticks and had been lined with sticks around the walls. The floor was covered with leaves, the decayed remains being still in the pit. Stones had been placed rather symmetrically around the lip of the hole and were found lying where they had been dropped when the wind had removed the sand that had supported them. The figure shows the probable appearance of the pit when newly made.

No traces of bones survived in the pit. The campsite has yielded few implements, the only significant ones being rather poor adze stones of the type often found on camps near Adelaide, and correlated on general grounds



with the Murundian culture of the Murray River, as described by Hale and Tindale.¹ The floor of the pit was covered with a double layer of sticks at right angles, these were enclosed in a square of sticks so chosen and placed that they filled the circular floor of the pit and made it level.

The sand below the floor of the pit appeared to be undisturbed; nevertheless we dug down to a depth of three feet, reaching a hard bottom without finding anything to elucidate the purpose of the pit.

We can only imagine that it is similar to the stick and leaf-lined burial pits made by the natives of the Wirangu tribe near Fowler

Bay on the West Coast of South Australia, which it resembles. No traces of bones exist, so that, if this is the case, the burial could only have been a temporary one. There are many references to smoked and dried bodies being carried from place to place before being disposed of by burial at the birthplace of the individual. Is this one a temporary repository for such a relic?

REFERENCE CITED.

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The Flora of Mount Remarkable

By

J. B. CLELAND AND E. H. ISING

The following party of members made the trip to Melrose and Mount Remarkable from December 26 to 29, 1938:—Misses E. Harwood and D. Matthews, Prof. J. B. Cleland, Messrs. W. A. Stow, L. C. Adcock, W. D. Wade, T. G. Errey and E. H. Ising (leader). Mount Remarkable is a towering mass 3,178 feet above sea level and is a part of the Flinders Range. Willochra Creek runs along the southern end and passes by the township of Melrose, which is at the base of the Mount. Arriving at mid-afternoon, on the first day the party explored the creek and collected plants, including some swamp specimens.

A full day was taken to climb Mount Remarkable. The Mount was approached from the Wilmington side and the foothills were climbed until a ridge was reached which extended to the top main ridge. From that point the summit was gained quite easily, after five hours' climbing. This entailed a climb of 2,020 feet. The Mount is clothed with vegetation, but has some patches of scree (loose stones), which are devoid of plant life. Gum trees (*Eucalyptus* spp.) were very numerous, the chief species being *E. elaeophora* with some *E. cladocalyx* (Sugar Gum). Large and small shrubs were plentiful. Not many plants were in flower, but quite a number of identifications were possible. Lunch was partaken of at the cairn at the summit, from where a wonderful view

was to be had. The descent was made over the same route, which proved as tiring as the ascent.

The second day was occupied by walking along the Port Germein road and returning down the Willochra Creek, in which were some beautiful waterholes. Along this creek the rare and dainty skullcap (*Scutellaria humilis*) was found. In the afternoon the local reserve was visited, where the rare blue lily (*Dianella laevis*) was seen several times. Passing through a forest of probably *Eucalyptus microcarpa*, the party had an experience with some bees and finally observed some fine bushes of "Golden Shower," which were taken back to our hotel for decorations.

The following very interesting plants were found:—

1. *Glycine tabacina* Benth. In "The Flora of South Australia," by J. M. Black, the author says that he had seen no South Australian specimen, but that it was recorded by Mueller ("Flora Australiensis," II, 1864, 244) from Crystal Brook and Rocky River. Mueller lived in South Australia from 1848 to 1852, when he went to Victoria, so that he collected his specimens at the latest in 1852. There is no record of this species being found since that time until this trip, when Prof. Cleland found specimens along the bank of the Willochra Creek. It is

therefore 86 years between the two collections. It was not found in flower, but the identification is reasonably certain from the fruit which was obtained. Mueller's localities are also in the Mount Remarkable district. This species is also found in all the States, except Tasmania, and in New Caledonia, Fiji and other Pacific islands.

2. *Hovea longifolia* var. *lanceolata* Benth. This plant is only found on Mount Remarkable, and was seen by the party on the eastern slope. This species is one of a genus which is noted, particularly in Western Australia, for its handsome flowers, of a deep blue colour. It was not in flower at the time of our visit (nor was it in flower in October, 1928). One of our party, Mr. Wade, noticed that the bushes of this species on the lower slopes had very few fruits, but the fruits became more numerous progressively as the summit was approached. This variety was more common in Australia than the type but strangely enough it does

not occur in Western Australia, which may be regarded as the home of the genus.

3. *Choretrum glomeratum* var. *chrysanthum* Benth. "Golden Shower" was coined by the party for this splendid shrub and it proved to be the gem of the excursion. It is a shrub of about six feet in height with numerous slender, sometimes drooping, branches with masses of small yellow flowers which cover most of the plant. It presented a lovely sight and brought forth admiration from all who saw it. We were fortunate in seeing this plant in its flowering stage, although regrets were expressed that no seed was available for those desirous of cultivating it. This yellow variety appears to be rare in our State, although the type with white flowers is more extensively known. The variety is known from the Murray and Avoca Desert (? Victoria) and Wheal Barton Mines (F. v. Mueller). The locality of this last place is unknown.

A GROOVED STONE MACE-HEAD?



During the Field Naturalists visit to Hallett Cove on February 24, 1940, Mrs. R. W. Edmeades found a curious implement made from soft stone in the form of a grooved and polished axe-head. What might be presumed to be the cutting edge is exceedingly blunt, and it is obvious that the stone was never meant for chopping. Were it not

that no previous example of such a thing has been recorded, we would unhesitatingly regard it as a stone mace-head, such as might be used for striking or hitting in warfare. Examination of several other examples of grooved axes in the South Australian Museum collection, including one from Mount Gambier and another from Cape Bridgewater, do suggest the possibility that they may have been used as a form of club-head.

It may be recalled that at Encounter Bay, as recorded by Meyer in 1845, the Ramindjeri people used a *kaitjengl*, an object made of "two sticks about a foot or fifteen inches long bound together with a stone between them at one end, used for enchanting." While this description recalls that of an aboriginal tomahawk, it seems likely that such objects were not well known or used.

Mrs. Edmeades find constitutes the south-westernmost example of an axe-like object yet found in South Australia, and it has been kindly presented to the South Australian Museum.

—N. B. Tindale.

The Flora of the Wudinna District, Eyre Peninsula

By

C. W. JOHNS

In the previous article published in this journal (Vol 19, No. 1), an account of the therophytic and other species found in the vicinity of rock outcrops was given. In the compilation of this second list an attempt has been made to group species, as they occur, in the habitats to which they appear to favor in the hope that the list may be of some value to ecological and other students of our flora. The exact associations are, however, difficult to define and this is due to the fact that many minor variations in the soil type occur in the vicinity of outcrops leading to transition or mixed formations. Another important factor is due to settlement of the areas and subsequent biotic influences acting on the communities, resulting in reversal of successions and movement of associations. Species found on the soils of better water relations such as soakages, swamps and sandhills are given first. These are followed by an account of those found on drier areas.

I.—COMMUNITIES IN DRAINAGE AREAS AND SOAKAGES FROM GRANITE OUTCROPS (Continued)

Near to the outcrops occur *Helipterum Jes-sonii*, *Stenopetalum sphaerocarpum*, *Polygonum plebeja* (E.P.), *Goodenia Haviandii* (E.P.), *Notholaena Brownii* (E.P.), *Velleia paradoxa*, *Pimelea simplex* var. *continua* and *Erodium cygnorum*. An associes of *Calythrix involucreta* occupies the next zone with the grasses *Aristida arenaria*, *Amphipogon strictus*, *Danthonia semiannularis*, *Lepturus incurvatus*, *Stipa variabilis* and *S. eremophila*. The ephemeral element consists of *Blennodia brevipes*, *B. canescens*, *Ixiolaena tomentosa*, *Angianthus pusillus*, *Ceratogyne obionoides* and *Mitrasacme paradoxa*. Orchids are represented by *Pterostylis nana*, *Thelymitra aristata*, *Caladenia reticulata*, *C. dilatata* and *C. latifolia* and *Cyperaceae* by *Lepidosperma laterale*. On slightly deeper red sandy soil and passing into the *Calythrix* associes on one side and *Melaleuca uncinata* on the other is usually a belt of *Baeckea Behrii*, with a slight undergrowth of epheme-

erals in winter and grasses in spring and summer.

Among the grasses *Microseris scapigera* grows. Little or no undergrowth is found under *Melaleuca uncinata* when the growth is dense. In the slight open spaces, however, *Caladenia cardiochila* (E.P.), *C. filamentosa* var. *tentaculata*, *Prasophyllum nigricans* and *Pterostylis mutica* have been observed. Also the leaf mould surrounding bushes is favored by *Didiscus pusillus*, *D. cyanopetalus*, and *D. ornatus*. Should a fire destroy the Broombush it has been noted that large numbers of *Calandrinia corrigioloides*, *Muehlenbeckia adpressa*, *Poranthera microphylla* (E.P.), and *Ophioglossum coriaceum* germinate. The *Melaleuca uncinata* association passes into a transition zone of mixed species to a *Eucalyptus* association.

II.—COMMUNITIES AND ASSOCIATIONS ON HEAVIER, DEEP, SANDY SOILS, RED IN COLOR AND CONTAINING A FAIR AMOUNT OF CLAY.

Near the outcrops and fringing the same in places, *Eucalyptus odorata* in mallee form is present. Otherwise the dominant tree is *E. gracilis* (Kong mallee) which grows to comparatively large trees, providing a timber which is white and resistant and used for fencing and other purposes. It is a shallow-rooted species, also grows on shallow red clay soils over limestone where it sometimes assumes a delicate pendulous habit. *E. oleosa* is not so frequent in these heavy red soils, but individual specimens occurring reach large size, contrasting with the shrub and whipstick forms of the drier areas. Its timber is subject to the ravages of white ant, but is useful for other purposes. Certain varieties produce a timber which is not favored by ants. *E. brachycalyx*, rather common, is of little use as timber, being soft and weak. *E. gracilis* often, in these situations and in watercourses, approaches *E. calycogona* in fruit and *E. fasciculosa* in having large terminal panicles. Undershrubs

are *Acacia ligulata*, *A. Oswaldii*, *A. sclerophylla* var. *lissophylla*, *A. Merrallii*, *Pittosporum phillyreoides*, *Pimelea microcephala*, *Geijera linearifolia*, *Alyxia buxifolia*, *Rhagodia parabolica*, *R. Preissii* (E.P.), *Cassia eremophila* var. *platypoda*, *C. Sturtii* and *Eremophila alternifolia* (the last named three being found also on flood plains). The open formation of the above mallee permits a prolific ground flora in winter and spring, consisting of the following:—*Helichrysum Tepperi* and *Helipterum polygalifolium* (forming compact carpets of yellow and white in spring), *Cuphonotus antipodus* (?) and *Phlegmatospermum* sp., *Goodenia pinatifida* and *G. pusilliflora*. In summer, grasses take possession. *Stipa platychaeta* climbs up through shrubs to a height of up to four feet. *Beyeria Leschenaultii* is common, and tussocks of *Lomandra effusa* may be present, sometimes sheltering under its sides in collected leaves, a plant of *Helichrysum leucopsidium*.

On the leeward south side of the Poldia rock there is a grey humus soil receiving a plentiful supply of moisture from the rock. The vegetation there is very dense and contains, among species already mentioned, *Eucalyptus angulosa*, *Callitris glauca*, *Leptospermum coriaceum*, *Bursaria spinosa*, *Acacia pycnantha* (?), *Thryptomene Miqueliana*, *Exocarpus cuneiformis*, *Opercularia varia* (E.P.), *Pomaderris racemosa*, *Eucarya acuminata*, *Lasiopetalum Baueri*. There is little undergrowth, but on occasional open spaces *Cynoglossum australe* var. *Drummondii* (E.P.), *Podosperma angustifolium*, *Thysanotus Patersonii*, *Hydrocotyle rugulosa* (E.P.), *H. pilifera* (E.P.), *Capsella pilosula*, and *Stellaria filiformis* occur. The above mixed community carries a flora akin to those of better rainfall areas.

The occurrence of rock debris and siliceous soil near the outcrop is the habitat of *Dodonaea attenuata*, *Scaveola linearis*, *Dampiera lanceolata*, *Rhagodia nutans*, *Goodenia robusta*, *Swainsona microphylla*, *Casuarina cristata*, *Hakea leucoptera* and var. *Kippistiana*, *Muehlenbeckia adpressa* and *M. dielina* (E.P.), (the latter rare). *Acacia calamifolia* var. *euthycarpa* is sometimes dominant.

III.—SANDHILL FLORA.

Soil type here consists usually of a mulch of loose grey sand varying from six inches to one foot in depth, overlying a yellow clay.

Water retention is good, the soil is cool in summer. These miniature hills are of unrivalled beauty in spring with a wealth of gold, blue and white flowers intermingled with the vivid green and plumes of tussocks of spinifex and swordrush.

Many species already noted as occurring on the moist slopes of outcrops, are also found on sandhills. These situations appear to form the only suitable remaining habitat for the "refuge" southern species, in the drier areas.

The chief shrubs are *Eucalyptus dumosa*, *E. transcontinentalis*, *E. conglobata* var. *anceps*, *E. angulosa*, *E. leptophylla*, *Callitris verrucosa* (E.P.), *Hakea multilineata*, *Grevillea pterosperma*, *G. vittata*, *Acacia farinosa*, *A. acanthoclada* (E.P.), *A. rigens*, *A. spinescens*, *Cryptandra amara* var. *longiflora* (E.P.), *Spyridium bifidum*, *S. coactiliiferum*, *Daviesia brevifolia*, *Eutaxia microphylla*, *Bossiaea Walkeri* (E.P.), *Baeckea crassifolia*, *Bertya Mitchellii* (E.P.), *Boronia inornata*, *B. caerulea*, *Phebalium bullatum*, *Billardiera cymosa*—as a twiner or bush, *Dicrastylis verticillata* (E.P.), *Eremophila glabra* var. *viridiflora*, *Hybanthus floribundus*, *Hibbertia virgata* var. *crassifolia*, *Hibiscus Pinonianus* var. *Drummondii*, *H. Farragei* (E.P.), *Leucopogon cordifolius*, *Prostanthera chlorantha* (E.P.), *Olearia ramulosa*, *O. microdisca* (E.P.), *O. Muellertii*, *O. pimeleoides*, *O. decurrens*, *O. ciliata*, *O. floribunda*, *Helichrysum rectusum*, *H. apiculatum*, *H. Haighii*, *Anthocercis myosotidea*, *Solanum coactiliiferum*, *Comesperma scoparium*, *Pimelea micrantha*, *Goodenia varia*, *G. affinis*, *Halgania cyanea*, *Lobelia gibbosa*, *Calotis cymbacantha*, *Convolvulus erubescens*, *Erechtites picridioides*, *Senecio brachyglossus*, *S. lautus*, *Podolepis capillaris*, *Waitzia acuminata*, *Velleia connata* (E.P.), *V. paradoxa*. Grasses are represented by *Triodia lanata*, a porcupine grass, gregarious in habit in drift, but spreading in circular patches with dead centres in sheltered positions under bushes. *Dianella revoluta*, *Lomandra glauca*, *L. leucocephala*, *Tricoryne elatior*, *Lepidosperma concavum*, *L. congestum* and other Cyperaceae.

IV.—PORCUPINE OUTCROPS OF RED IRONSTONE SOILS OVER TRAVERTINE LIMESTONE.

The dominant in this community is *Triodia irritans*, *Melaleuca acuminata*, *Dodonaea hexandra*, *Microcybe pauciflora*, *M. multi-*

flora, *Calythrix tetragona* and *Cryptandra amara* (E.P.), are scattered shrubs. *Thysanotus dichotomus* (often growing up through *Triodia* tussocks), *Minuria leptophylla* and *Gahnia lanigera* are common.

The heavy timbered scrub adjoining outcrops merges into that of the surrounding plains dominated by the *Eucalyptus oleosa*, *E. gracilis* association. The soil varying between light cocoa color over limestone rubble and dark chocolate of an alluvial nature. In open spaces in this association the following species occur:—*Melaleuca pubescens* (either in dense societies on a flood plain or as scattered bushes), *Myoporum platycarpum*, *Dodonaea stenozyga*, *D. bursarifolia*, *Westringia rigida*, *Halgania lavandulacea*, *Eremophila Weldii*, *E. scoparia*, *E. glabra*, *Myoporum deserti*, *Cratystylis conocephala*, *Atriplex stipitatum*, *Clematis microphylla*, *Cassitya pubescens*, *Loranthus mirabilis* (parasitic on *Melaleuca pubescens* bushes), *Kochia triptera* var. *pentaptera*, *Trichinium seminudum* and annuals. In this drier country away from outcrops, monospecific communities of *Acacia calamifolia* var. *euthycarpa*, *Acacia colletioides*, *Dodonaea attenuata* and *Casuarina pusilla* are found in local swamps similar to those of Central Australia.

Country consisting of plains of broken limestone and white sandy soil carries many plants of the steppe formation, viz., *Zygochloa fruticulosa*, *Z. apiculata*, *Z. Billardieri*, *Z. glaucescens*, *Z. ovatum*, *Z. ammophilum* (chiefly under open mallee), *Atriplex crassipes*, *Chenopodium desertorum*, *Bassia uniflora*, *B. sclerolaenoides*, *B. parviflora*, *B. obliquicuspis*, *Kochia brevifolia*, *K. tomentosa* and var. *appressa*, *K. crassiloba* (E.P.), and *Salsola Kali*.

V.—SALT LAKE VEGETATION, SOUTH OF WUDINNA.

Near the water level *Arthrocnemum halocnemoides* and *Salicornia australis* are present. Many ephemerals grow on favorable slopes

leading to the lake. *Calandrinia volubilis* has been noted attaining large dimensions and becoming very succulent. Many plants found around rock outcrops are present, such as *Geococcus pusillus* (E.P.), *Hymenolobus procumbens*, *Cotula australis*, *Ranunculus parviflorus*, *Frankenia pauciflora*, and *F. fruticulosum* appear on other slopes. Beyond this zone *Atriplex paludosum*, *A. cinereum*, *Threlkeldia diffusa*, *T. salsuginosa*, *Hemichroa diandra* and *Tetragonia eremaea* exist in scattered form. If the lake adjoins a sandhill, the immediate sand is bounded by *Darwinia micropetala*, backed up by a zone of *Melaleuca uncinata* and *M. halmaturorum*. The sandhill itself carries a scrub type of *Eucalyptus oleosa* and *E. leptophylla* mallee, which develop exceptionally large gnarled trunks clothed with large quantities of strips of bark. Fruiting capsules are rarely seen on these trees. The Quondong assumes a weeping habit. The undershrubs are *Acacia rigens*, *A. farinosa*, *Hakea ulicina*, *Beyeria opaca* (E.P.), and *Homoranthus Wilhelmi*.

VI.—LIST OF SPECIES OF FACULTATIVE PLANTS, Etc.

These are found in many different types of soil and situations, but remain apparently an overflow from other communities.

Chenopodium pumilio (E.P.), *Ch. cristatum*, *Alyssum linifolium*, *Stenopetalum lineare*, *Brachycome ciliaris*, *Calotis hispidula*, *Vitadinia triloba*, *Erechthites quadridentata*, *Gnaphalium japonicum*, *G. luteoalbum*, *Helichrysum bracteatum*, *Athrixia tenella*, *Angianthus tomentosus*, *Pelargonium australe*, *Goodenia pinnatifida*, *Stipa variabilis*, *S. cremophila*, *Acacia notabilis*, *Teucrium sessiliflorum*, *Eremophila crassifolia*, *Comesperma volubile*, *Parietaria debilis* var. *australis*—a shade plant; *Urtica urens*, *Daucus glochidiatus*, *Gnephosis skirrophora*, *Enchylaena tomentosa*, *Craspedia pleiocephala*, *Euphorbia Drummondii*.

Those marked (E.P.) are species not previously recorded for Eyre Peninsula.

LUMINESCENCE IN OSTRACODS

During February, 1940, I noted a large area of the sea near the shore at Glenelg literally dotted with mobile pale green lights each about the size of a finger nail. The sea was calm and warm, and there was no moon. I attempted to gather some of the creatures responsible for these lights, but without success. I then noted a similar light in a

piece of seaweed which had been washed up by the now receding tide. I gathered it up carefully and examined the weed with the aid of a torch. The creature producing the light was not more than 1/16th inch long, and in appearance not unlike a minute molluscan bivalve shell. This proved to be an Ostracod (class Crustacea).—H. T. Condon.

List of Plants Near Melrose

(MOUNT REMARKABLE)

By

E. H. ISING AND J. B. CLELAND

The following list of plants within walking distance of Melrose has been compiled as a result of several visits, the last, that of the Field Naturalists' Section, in December, 1938. The list cannot be considered as in any way complete, but merely as a basis to which additions can be made from time to time. The number of species recorded is 239, of which 50 are introduced. Mr. J. M. Black has kindly identified a number of species for us, and Dr. R. S. Rogers has supplied us with a list of the orchids. An asterisk * indicates an introduced species.

Filicales:—*Cheilanthes tenuifolia* Swartz; *Notholaena Brownii* Desv.; *Gymnogramme leptophylla* (L.) Desv.; *Pleurosorus rutifolius* (R.Br.) Fee.

Pinaceae:—*Callitris glauca* R.Br., Native Pine; *C. propinqua* R.Br.

Typhaceae:—*Typha angustifolia* L., Bulrush.

Gramineae:—*Andropogon exaltatus* R.Br. L., Scent-grass (narrow-leaf form); *Themeda triandra* Forsk., Kangaroo-grass; *Digitaria Brownii* (R. et S.) Hughes; *Paspalidium gracile* (R.Br.) Hughes (railway line); *Panicum effusum* R.Br.; **Phalaris minor* Retz; *Aristida Behriana* F.v.M.; *Stipa variabilis* Hughes; *Oryzopsis miliacea* (L.) Aeschers et Schweinf., Many-flowered Millet-grass; *Polypogon monspeliensis* Desf., Beard-grass; *Agrostis verticillata* Vill.; *Calamagrostis filiformis* (Forst.) Pilger, Blown Grass; **Avena fatua* L., Wild Oat; **A. barbata* Brot., Bearded Oat; *Danthonia semianularis* (Labill.) R.Br.; *Pappophorum nigricans* R.Br., Black Heads; *Triodia* sp., Porcupine Grass; **Briza minor* L., Lesser Quaking-grass; *Poa caespitosa* Forst.; **Bromus villosus* Forst., (= *B. maximus* Desf.), Great Brome; **B. madritensis* L., Madrid Brome; *Cynodon dactylon* Rich., Couch-grass; *Chloris acicularis* Lindl., Spider Grass (railway line); **Lolium* sp.; *Agropyrum scabrum* (Labill.) Beauv.; **Hordeum murinum* L., Barley-grass.

Cyperaceae:—*Cyperus vaginatus* R.Br.; *Schoenus apogon* Roem. et Sch.; *Scirpus cernuus* Vahl.; *S. americanus* Pers.;

S. littoralis Schrad.; *Cladium articulatum* R.Br.; *Lepidosperma concavum*, R.Br. (or *L. laterale* R.Br.); *L. viscidum* R.Br.; first record for north; *Carex appressa* R.Br.

Juncaceae:—*Juncus bufonius* L., Toad Rush; *J. pauciflorus* R.Br.; *Luzula campestris* D.C. Field Woodrush.

Liliaceae:—*Dianella revoluta* R.Br.; *D. laevis* R.Br.; *Anguillaria dioica* R.Br.; *Lomandra dura* (F.v.M.) Ewart; *L. filiformis* (Thunb.) J. Britten, slopes of Mt. Remarkable; *Thysanotus Patersonii* R.Br.; *Bulbine bulbosa* (R.Br.) Haw.; *Xanthorrhoea quadrangulata* F.v.M.

Amaryllidaceae:—*Hypoxis pusilla* Hook.f.; *Calostemma purpureum* R.Br.

Orchidaceae (mostly identified by Dr. R. S. Rogers):—*Microtis* sp. (not in flower); *Prasophyllum* sp.; *Acianthus exsertus* R.Br.; *Caladenia filamentosa* R.Br., var. *tentaculata* Tate; *C. deformis* R.Br.; *Diuris* sp.; *Pterostylis nana* R.Br.; *Pt. longifolia* R.Br.; *Pt. vittata* Lindl.

Casuarinaceae:—*Casuarina stricta* Ait.

Urticaceae:—*Parietaria debilis* G. Forst.

Proteaceae:—*Hakea ulicina* R.Br.; *Grevillea lavandulacea* Schl. (rather prickly, leaves narrow).

Santalaceae:—*Exocarpus cupressiformis* Labill; *Choretrum glomeratum* R.Br. var. *chrysanthum* Benth.; *Eucarya acuminata* R.Br., Native Peach.

Loranthaceae:—*Loranthus Miquelii* Lehm. on *Eucalyptus microcarpa*.

Polygonaceae:—*Rumex pulcher* L., Fiddle Dock; *R. Brownii* Campd.; **R. crispus* L., Curled Dock; **Polygonum aviculare* L., Wireweed.

Chenopodiaceae:—*Rhagodia nutans* R.Br.; *Chenopodium carinatum* R.Br., Keeled Goosefoot; **Ch. murale* L., Nettle-leaved Goosefoot; *Atriplex Muellieri* Benth.; *A. campanulatum* Benth.; *Kochia Georgei* Diels.; *K. crassiloba* R. H. Anders; *Salsola Kali* L., Roly Poly; *Enchylaena tomentosa* R.Br., Ruby Saltbush.

Amarantaceae:—*Trichinium spathulatum* R.Br.

- Nyctaginaceae*:—*Boerhavia diffusa* L.
Portulacaceae:—*Calandrinia* sp.
Caryophyllaceae:—*Spergularia rubra* (L.) J. et C. Presl.; *Tunica prolifera* (L.) Scop., Proliferous Pink (in the Reserve at Melrose); **Silene nocturna* L.; **S. gallica* L., French Catchfly.
Ranunculaceae:—*Clematis microphylla* DC., *Ranunculus lappaceus* Sm., Buttercup; *R. parviflorus* L.; **R. muricatus* L.
Lauraceae:—*Cassytha pubescens* R.Br.
Papaveraceae:—*Papaver hybridum* L., Rough Poppy; **Fumaria capreolata* L.
Cruciferae:—**Nasturtium officinale* R.Br., Watercress; **Sisymbrium officinale* L., Hedge Mustard; **S. erysimoides*; **S. orientale* L., Wild Mustard; *Lepidium hyssopifolium* Desv.
Droseraceae:—*Drosera Planchonii* Hook.f.; *D. auriculata* Backh.
Crassulaceae:—*Crassula Sieberiana* (Schultes) Ostenf.
Pittosporaceae:—*Bursaria spinosa* Cav., Native Box; *Billardiera cymosa* F.v.M.
Rosaceae:—**Rosa canina* L., Dog Rose; *Acaena ovina* A. Cunn.
Leguminosae:—*Acacia spinescens* Benth.; *A. pycnantha* Benth., Golden Wattle; *A. verticillata* (L'Her.) Willd. (with galls of *Uromycladium*—summit of Mt. Remarkable); *Daviesia corymbosa* Sm.; *D. genistifolia* A. Cunn.; *Eutaxia microphylla* (R.Br.) J. M. Black; *Pultenaea graveolens* Tate var. *glabrescens* J. M. Black (slopes of Mt. Remarkable); *P. largiflorens* F.v.M.; *Hovea longifolia* R.Br. var. *lanceolata* Benth.; **Trifolium procumbens* L., Hop Clover; **Medicago sativa* L., Lucern; **M. denticulata* Willd., Toothed Medic; *Lotus australis* Andr.; *Indigofera australis* Willd.; *Psoralea patens* Lindl.; *Kennedy prostrata* R.Br., Scarlet Runner; *Hardenbergia monophylla* (Vent.) Benth., Native Lilac; *Glycine clandestina* Wendl.; *G. tabacina* (Labill.) Benth.
Geraniaceae:—*Geranium pilosum* Forst var. *australis* Ostenf.; *Erodium cygnorum* Nees.
Oxalidaceae:—*Oxalis corniculata* L.; **O. cernua* Thunb.
Euphorbiaceae:—*Phyllanthus saxosus* F.v.M.; **Ricinus communis* L., Castor Oil Plant; *Euphorbia Drummondii* Boiss.; *Beyeria Leschenaultii* (DC.) Baill. var. *rosmarinoides* Baill.
Stackhousiaceae:—*Stackhousia monogyna* Labill.
Sapindaceae:—*Dodonaea viscosa* L.; *D. attenuata* A. Cunn.
Rhamnaceae:—*Pomaderris racemosa* Hook.; *Spyridium parvifolium* (Hook.) F.v.M.; *Cryptandra* sp.
Malvaceae:—**Malva parviflora* L.; *Sida corrugata* Lindl.; *Hibiscus Huegelii* Endl.
Dilleniaceae:—*Hibbertia acicularis* (Labill.) F.v.M. var. *sessiliflora* J. M. Black.
Guttiferae:—*Hypericum gramineum* Forst. f.
Violaceae:—*Hybanthus floribundus* (Lindl.) F.v.M.; *Hymenanthera angustifolia* R.Br., amongst loose rocks on the lower slopes of Mt. Remarkable, westwards of Melrose.
Thymeleaceae:—*Pimelea stricta* Meisn.; *P. petrophila* F.v.M.
Lythraceae:—*Lythrum Hyssopifolia* L., Lesser Loosestrife.
Myrtaceae:—*Callistemon teretifolius* F.v.M.; *Eucalyptus odorata* Behr. et Schlecht., plains and foothills; *E. microcarpa* Maiden, foothills; *E. albens* Miq., White Box, foothills; *E. cladocalyx* F.v.M., Sugar Gum; *E. rostrata* Schlecht., Red Gum, creeks; *E. elaeophora* F.v.M., Bastard Box, upper slopes; *E. leucoxydon* F.v.M., Blue Gum; *Calythrix tetragona* Labill.
Oenotheraceae:—*Epilobium junceum* Sol.
Halorrhagidaceae:—*Halorrhagis elata* A. Cunn.
Umbelliferae:—*Hydrocotyle laxiflora* DC.
Epacridaceae:—*Astroloma humifusum* (Cav.) R.Br. and var. *denticulatum* (R.Br.) J. M. Black, Native Cranberry-plants upright.
Primulaceae:—**Anagallis arvensis* L., Scarlet Pimpernel; **A. femina* Mill., Blue Pimpernel.
Oleaceae:—**Olea europaea* L., Olive.
Loganiaceae:—*Logania vaginalis* (Labill.) F.v.M.
Gentianaceae:—*Erythraea Centaurium* Pers., Common Centaury.
Convolvulaceae:—*Convolvulus erubescens* Sims; *Dichondra repens* Forst et f.
Borraginaceae:—*Heliotropium europaeum* L.; **Echium plantagineum* L., Salvation Jane.
Labiatae:—*Ajuga australis* R.Br., Bugle; **Marrubium vulgare* L. Horehound; **Salvia Verbenacea* L., Wild Sage; *Scutellaria humilis* R.Br., along the

creek bed, first record for the Northern District.

Solanaceae:—*Solanum nigrum* L., Black Nightshade; *S. simile*, F.v.M.; *S. cinereum* F.v.M.; *Lycium australe* F.v.M., Australian Boxthorn; **L. ferocissimum* Miers., African Boxthorn; **Datura metel* L.; *Nicotiana velutina* Wheeler; **N. glauca* Grah., Tree Tobacco.

Scrophulariaceae:—**Linaria elatine* (L.) Mill. var. *lasiopoda* Vis., Pointed Toad-flax; *Veronica decorosa* F.v.M.

Myoporaceae:—*Myoporum montanum* R.Br., leaves to 16 mm. wide; *M. viscosum* R.Br.

Plantaginaceae:—*Plantago varia* R.Br.

Rubiaceae:—*Opercularia turpis* F.v.M.; *Pomax umbellata* Sol.; *Galium Gaudichaudii* DC.

Cucurbitaceae:—**Cucumis myriocarpus* Naud., Paddy Melon.

Campanulaceae:—*Wahlenbergia* sp.; *Lobelia anceps* Thunb.; *Isotoma petraea* F.v.M.

Goodeniaceae:—*Goodenia affinis* De Vriese; *G. robusta* (Benth.) Krause; *G. ovata* Sm.; *G. amplexans* F.v.M.; *G. albiflora*

Schl.; *G. pinnatifida* Schl. (?); *Dampiera lavandulacea* Lindl.

Compositae:—*Vittadinia triloba* (Gaudich.) DC.; *Olearia pannosa* Hook.; **Xanthium spinosum* L., Bathurst Burr; *Cotula coronopifolia* L.; *Erechthites quadridentata* (Labill.) DC.; *Senecio odoratus* Hornem; *Cymbonotus Lawsonianus* Gaudich.; **Cryptostemma calendulaceum* (L.) R.Br., Cape Dandelion; *Gnaphalium luteo-album* L.; *Cassinia laevis* R.Br.; *C. complanata*, J. M. Black; *Ixiolaena tomentosa* Sond. et F.v.M.; *Helichrysum leucopsidium* DC.; *H. apiculatum* (Labill.) DC.; *H. semipapposum* (Labill.) DC.; *H. retusum* Sond. et F.v.M.; *Leptorrhynchus* sp.; **Inula graveolens* (L.) Desf., Stinkwort; *Calceophalus citreus* Less.; *Craspedia uniflora* Forst., Bachelor's Button; *C. globosa* Benth., a handsome plant with large round heads; **Cirsium lanceolatum* (L.) Scop., Spear Thistle; **Carduus tenuiflorus* Curtis, Slender Thistle; **Silybum marianum* (L.) Gaertn., Milk Thistle; **Centaurea melitensis* (L.) Maltese Cockspur; **Carthamus lanatus* L., Woolly Star Thistle; *Microseris scapigera* (Forst. f.) Schultz-Bip.; **Hypochocris radicata* L., Rooted Cat's-ear; **H. glabra*, Glabrous Cat's-ear; **Sonchus oleraceus* L., Sow-Thistle; **S. asper* Hill, Prickly Sow-Thistle.

LIST OF SHELLS COLLECTED AT MELROSE.

By

MISS D. MATTHEWS.

Fresh water, Willochra Creek.

1. *Amerianna subundata*.
2. *Lymnaea subaquatilis*.
3. *Sphaerium tatariae*
4. *Isodorella newcombi*
5. *Potamopyrgus gunni*

Land Shell:—

1. *Meracomelon rufofasciatum*.

These are the first records for the district.

SKELETONS AT BRENDA STATION.

Mr. S. Wilcox recently drew the attention of the Museum authorities to the presence on Section 228, Hundred of Eba, on his property, of a native burial ground. Mr. N. B. Tindale visited the site and, on the bank of the Murray River, at a point due east of Brenda homestead, found three burials, probably of a man, an aged woman and a young child. The bodies were lying in the straight out position with the head directed to the west. The adults were lying on their left sides, and the child on its right. Closely associated with the remains were the buried remains of no fewer than five native dogs, a feature which has not previously been noticed in burials along the River Murray.

The Field Naturalists' Section

EXCURSIONS

1940			
May 25—Morialta	Tram, 2 p.m.	Ecology of Res.	Prof. J. B. Cleland
June 1—Museum	Entrance, 2 p.m.	Lecturettes	Various
10—Roseworthy College, 9 a.m.	Motor (4/6)	Agriculture	Dr. A. R. Callaghan
15—Henley to Glenelg	Tram, 1.30 p.m.	Intertidal Life	Mr. G. Pattison
29—National Park	Train, 1.14 p.m.	Foliage	Mr. E. H. Ising
July 13—Semaphore to Grange	Train, 1.10 p.m.	Marine Life	Miss D. M. Matthews
23—Zoological Gardens	Gates, 2 p.m.	Zoology	Mr. R. R. Minchin
Aug. 3—Anstey's Hill (1.45 p.m.)	Motor (3/-)	Physiography	Dr. C. Fenner
10—Outer Harbor	Train, 1.10 p.m.	Mud Flat Life	Mrs. L. E. Elliott
24—Black Hill (1.45 p.m.)	Motor (1/9)	Foothills Flora	Mr. W. A. Stow
31—Kingston Park Reserve	Train, 1.11 p.m.	Shrubs & Plants	Prof. J. B. Cleland

TRAM EXCURSIONS.—Meet in Grenfell Street by T. & G. Building.

TRAIN EXCURSIONS.—Will members obtain their tickets and meet on the train.

MOTOR EXCURSIONS.—Meet at the Town Hall, Adelaide. Bookings close with the Secretary or the Treasurer three days before excursion, and seats will be allotted in order of priority.

EVENING MEETINGS

1940.		
May 21—"The Aborigines"	Mr. N. B. Tindale	July 16—Microscope Evening Mr. J. D. O. Wilson
		"The Micro Lepidoptera."
June 18—The Malacological Society Evening.		Aug. 20—Annual Meeting.
Chairman	Mrs. L. E. Elliott	"How Solis Determine the Distribution of Plant Life"
		Prof. J. A. Prescott

MALACOLOGICAL SOCIETY: Evening Meetings

1940.		
May 6—Common Minute Gastropods, Mr. B. C. Cotton		July 1—Life of the Ocean, Miss D. M. Matthews
20—1 Marden Road, Marden, Mrs. L. E. Elliott		15—Apertures of Gastropods, Mr. F. K. Godfrey
June 3—Anthochiton Species, Mr. W. M. Nielsen		Aug. 5—Annual Meeting
17—Shells Studies	Mrs. G. Edmeades	19—Some Attractive Foreign Shells, Mr. W. Tucker

FIELD NATURALISTS' SECTION OF THE ROYAL SOCIETY.**Publications of the Section.****PUBLICATION No. 1.**

The National Parks of Australia, by Wm. H. Selway.
(Out of print.)

PUBLICATION No. 2.

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by
Prof. J. B. Cleland, M.D., and Prof. Walter Howchin, F.G.S.
Price 1/-.

PUBLICATION No. 3.

Botany and Geology of Coast from Outer Harbour to Sellick's Beach,
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BLACK-THROATED WHIPBIRD

Western Australian sub-species above.
Eastern Australian sub-species below.

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AFTER BUSHFIRE**

ORCHID NOTES

VOLUME 20, No. 3.
SEPTEMBER 30, 1940.

Registered at the G.P.O.,
Adelaide, for transmission
through the post as a
periodical.

**The South Australian
NATURALIST**

JOURNAL OF THE FIELD NATURALISTS' SECTION OF THE
ROYAL SOCIETY OF SOUTH AUSTRALIA.

Price: One Shilling.

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THIS Section was founded in 1883 for the purpose of affording observers and lovers of Natural History regular and frequent opportunities for discussing those special subjects in which they are naturally interested: for the Exhibition of Specimens; and for promoting Observations in the Field by means of Excursions to various collecting grounds around the Metropolis.

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MEMBERS are requested to invite their friends to these Monthly Meetings.

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MEMBERS are urged to take Receptacles for the carrying of Specimens. At each outing every member is expected to collect Specimens wherever possible, and to hand them to the Leader for identification, etc.

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Shell Money on Rossel Island, Papua

By

H. K. BARTLETT

This paper deals in a brief way with the monetary system of the people of Rossel Island, one of the thirty inhabited islands of the Louisiade Archipelago, off the south-east coast of New Guinea.

There is a system of wealth exchange amongst the people of Misima and Panacati. Wealth consists of green-stone axes and strings of "beads." The former are known as "*Abaraga*" and the latter as "*Bagi*." Both are used in the purchase of canoes, pigs, etc. A good canoe will probably be valued at from 40 to 50 "axes," each of which is valued to-day at from £2 to £5, according to the size of the "axe" and the quality of the stone. The "*Bagi*" is often exchanged between the parents of a couple on their wedding day. The "*Bagi*" is made of small discs cut from the red *Spondylus* shell.

Armstrong says: "They are systematically inter-related as regards value, and any commodity or service may be more or less directly priced in terms of them."

Ndap, of which there are 22 main values, is made from what appear to have been *Spondylus* shells. Each piece of shell currency is roughly triangular in shape, and a small hole is usually bored at one corner. The shell is said to have come from Yongga Bay, on the western end of the island, and to be made from a large bivalve, which is supposed to be plentiful in that bay. The waters from which the original shell was taken (according to legend) are strictly "taboo," natives firmly believing that anyone diving into the sea at the spot would be afflicted with a disease that would cause his head to become like a coconut, and death



Ndap shell money from Rossel Island (specimens A. 19919-21 in S.A. Museum).

Strings of it are valued at £1 per foot, and a full length usually measures 6 feet. These forms of wealth can scarcely be termed "money."

At Rossel Island, however, there appears to be a definite monetary system. It has already been well studied by W. E. Armstrong.¹

There are two types of shell money, of which

would follow. The "priest" of the tabu spot is able to remove the sickness on the payment of certain "money," but the tabu is so feared that I do not think that a Rossel Islander would live if he even by accident fell into the water. In Dyindyo village (Dec. 15, 1933) I saw a shell which was new to me. It was a large *Spondylus*, about 6 inches long and 4 inches wide. It was a "dead" shell, worm eaten, and heavily coated with lime. Natives told me that it

(1) Armstrong, W. E., 1928, Rossel Island, Cambridge.

"The South Australian Naturalist," c/o Royal Society Rooms, North Terrace, Adelaide.

Editorial

The Malacological Society of South Australia will shortly publish a second part of the "Systematic List" of the Mollusca of South Australia. This will cover the Scaphopoda (Tusk Shells), Cephalopoda (Octopus, Squids), Pelecypoda (Cockles), and Crepidopoda (Chitons), thus finishing the first complete list of South Australian Mollusca.

A popular account of common "Sea Shore Shells" of South Australia is being prepared, and will probably appear in the next issue of this publication. Some seventy-five pen-drawings illustrate the article and both popular and scientific names given.

Mr. Gregory M. Mathews, C.B.E., one of the world's leading ornithologists and an eminent authority on Australian birds, visited Adelaide during August and September. He conferred with Mr. H. T. Condon, State Secretary of the Royal Australian Ornithologists Union, on important aspects of Australian ornithology. He also examined many private collections of bird skins as well as those of the State collection.

Mr. N. B. Tindale and other members of the South Australian Museum staff have developed the Egyptian collections as part of the scheme to reorganise the Museum on more modern lines. The Egyptian specimens are now displayed on the second floor of the Eastern Wing.

The room has been decorated with murals by Mr. H. T. Condon depicting the creation myths of the Egyptians. Nuit, the sky goddess, is raised by Shu to form the heavens and Sib, the earth, bewails his lost bride.

Among the principal exhibits of the collection is the mummy and coffin of Renpit Nefert, a

wealthy woman of Akhmin, who died about 500 B.C. Other exhibits reveal the continuity of Egyptian history from the period of the Badarians (about 8000 B.C.) until modern times.

Prominent in the collection are examples of cloths and fabrics, principally from the period of the Ptolemys and from Coptic times. The earliest specimen in the collection is a Solutrean type implement from the Western Desert in Libya, which probably dates back to the middle of the Pleistocene and the more recent examples include relics of the Greek occupation of Egypt in the first century of the present era. Replicas of basalt statues of early kings and queens have been effectively colored by Mr. A. Hay to simulate their original splendor.

We are looking forward to the appearance of the descriptive booklet now in course of preparation by Messrs. Tindale and Condon explaining the exhibits.

Our Herbarium is now safely housed in a suitable room at the S.A. Museum. The recently elected Herbarium Committee will shortly start work on the arrangement of this collection, and additional material is expected shortly from various sources.

A named display of native wildflowers, situated near the entrance to the Museum, is now a regular feature.

Mr. G. P. Whitley's excellent new book, "The Fishes of Australia, Part 1, Sharks, Rays, and Other Primitive Fishes of Australia and New Zealand," sets a still higher standard in Australian zoological literature. The author is Ichthyologist at the Australian Museum and, as the Victorian "Naturalist" quotes: "Australia's foremost scientific worker of to-day amongst fishes." The book makes pleasant reading, interspersed as it is with flashes of rare humor amongst the comprehensive accumulation of information—a book for the layman as well as the scientist!

Back numbers of "The South Australian Naturalist" are getting scarce. If any member has copies to spare, the Magazine Secretary will be pleased to have them.

was known to them as "*ndyile*," from which the *ndap* and *nko* are made . . . one valve being use for *ndap*, and the other for *nko*. The value of *ndap* appears to be determined by its color, which varies from white to yellow and red. I was told that green specimens of the shell are sometimes washed up, but I have not seen a "coin" of that color.

Wonajo, one of the gods, is supposed to have made all the *ndap* from shell taken from Yongga Bay. I have seen *ndap* in the process of being made, but natives readily distinguish between the genuine old stuff and the "counterfeit" *ndap* made by certain "get rich quick" individuals.

Of the 22 main values of *ndap* there are probably more than one thousand pieces of each value from 1 to 11. There are said to be 20 pieces each of Nos. 12, 13, 14, 15, and 19; 14 each of Nos. 18 and 20; 13 of No. 21; and 10 each of 16, 17, and 22. Old men, resenting the impact of our civilisation, are said to be burning and destroying the more valuable pieces. Armstrong says that . . . "there would probably be less than a thousand *ndap* coins altogether." My conclusion, based on the number of "coins" that I have seen, is that there are many thousands of pieces.

Ndap is frequently loaned, and a rate of interest is charged on the loan. A brief period necessitates the repayment of a *ndap* of slightly higher value, probably one of the intermediate values, not included in the 22 main values mentioned above. For a longer period the rate is higher—e.g., a No. 5 must be repaid for the loan of a No. 4; but for a very long period it might be necessary to pay a No. 6 for the loan of a No. 4. Repayment must be made by a single "coin."

A No. 2 and a No. 4 will not be accepted as payment where a No. 6 is due. This necessitates further borrowing, although the debtor might have in his possession many "coins" of both higher and lower denominations. He must find a No. 6 to meet his obligations. He does not need to wander about seeking a loan from all and sundry, for there are coin brokers who live by borrowing on long terms and lending on short ones. These gentlemen have become very

shrewd dealers, and frequently are the "richest" men in the community.

The exchange rate appears to lapse at about No. 18, although "coins" of higher denomination are sometimes given as security for a No. 18. I have not been able to ascertain who own the No. 18 *ndap*, but as they are of such great importance, I conclude that they are the property of the chiefs. Since the higher values were at one time used for the purchase of the bodies of victims for the death feasts of chiefs, they have now ceased to be of much value to the community.

The purchase of pigs, wives, canoes, etc., involves the use of "money." A No. 18 *ndap* is the necessary payment for a wife, although there are probably payments of other values. Young men, not able to obtain a No. 18 *ndap* for a wife, will sometimes pool their wealth, and six or eight of them will become the owners of a girl. (Apparently in this case the father accepts a number of lesser value "coins" in lieu of a No. 18.) The girl is known as *tylibi*, and may become a woman of loose character, on feast days bringing many pieces of *ndap* to her owners. It sometimes happens that one of the members of the "syndicate" obtains possession of a No. 18 *ndap*. He then buys up all the shares, pays the father of the girl the required No. 18, takes the woman away into the rugged hills, builds a home of sago leaves, and lives more or less happily ever after.

Pigs are few in number on Rossel Island. They are so fat that, although they are sometimes able to stand on their feet, walking is almost impossible for them. The pig lives under the house of its owner. At a pig feast certain special cuts bring a high price. I have seen a basket full of *ndap* on such an occasion, for everyone pays *ndap* to partake of the feast.

The second type of shell money, called *nko*, is said also to have been produced by *Wonajo*. *Nko* is roughly circular in shape, the value of the discs varying according to size and thickness.

For ordinary purposes, ten discs of uniform size are strung on a piece of creeper. On certain ceremonial occasions the *nko* is

made into ropes several fathoms in length. These ropes contain hundreds of discs. The Rossel Islander is able to count to ten thousand. This is rather a remarkable achievement, especially when we remember that the counting of some native peoples is restricted

ped to protect them from prying eyes, and from the light of the sun. It seems evident that the use of *ndap* and *nko* approximates to the use of coins in our own country. The following are the names given to the various values of *ndap*, although many



Nko shell money from Rossel Island (specimens A. 19922-23 in S.A. Museum).

to the numbers 1 to 20—i.e., two hands and two feet (10 fingers and 10 toes).

Armstrong suggests that *nko* are made from the shell of the giant clam. I favor the explanation given above—viz., that *nko* are made from the valve of a *Spondylus* shell. I am led to this conclusion by the fact that there is much red on the *nko* discs, whereas red is seldom, if ever, found on the shells of the giant clam in these waters. I saw a piece of newly-made *nko* which had been fashioned from the thick part of the common red *Spondylus* (*sapisapi*). I have in my possession a shell (known locally as *ndapele*) which I have not been able to identify, but which is similar in appearance to the *nko* and *ndap*.

Nko exchanges and rates of interest are similar to those of *ndap*, although some important differences occur. The higher values of both *ndap* and *nko* are very closely guarded, and as each "coin" has its own particular name, and the holder of each rare piece is known to all, no one would dare to sell a piece to an outsider. As a result, it is impossible to get even a glimpse of the "precious coins." They are carefully wrap-

pieces have individual names:

- | | |
|-----------------------|---------------------|
| 1. Dwondwo. | 12. Tangwolondo. |
| 2. Gamo. | 13. Kwarunundo. |
| 3. Kejim. | 14. Pimba. |
| 4. Pwomondap. | 15. Yananindo. |
| 5. Kwaia. | 16. Gumindo. |
| 6. Uabe. | 17. Bwelejungwanagu |
| 7. Tebuda. | 18. Tyomundi. |
| 8. Tebudongwo. | 19. Tejema. |
| 9. Tiama. | 20. Gemida. |
| 10. Yelengwindo. | 21. Pwojuma. |
| 11. Yelengwinjinindo. | 22. Kwojuma. |

I am indebted to Mr. B. C. Cotton for the identifications of the shells. He writes: "Although I have not seen the shell in its natural state, from the pieces forwarded as 'shell money' it appears that the species used to manufacture the money is possibly *Spondylus multisetosus*, Reeve."

Vascular Plants of the Sutherlands, Bower, and Mount Mary Districts, S.A.

By

E. F. BOEHM

Sutherlands, S.A., 1/10/1939.

The area dealt with in this paper is situated east of Eudunda, and is traversed by the railway line from Adelaide to Morgan. At Sutherlands the average annual rainfall is 10.73 inches. Bower and Mount Mary have a lower average annual rainfall. The soil of much of the area consists of chocolate-brown loam, with nodular travertine limestone. Flats are characterised by a warm brown loam without the limestone nodules. In its virgin state the area was covered with scrub comprising *Eucalyptus* spp., *Myoporum platycarpum*, and *Geijera linearifolia*. *Atriplex* spp., *Rhagodia* spp., and *Kochia* spp. were prominent in the shrub stratum. The vegetation may be classed as a *Eucalyptus oleosa*-*Myoporum platycarpum* stratum society, and it commences at about the 12 inches annual isohyet, west of Sutherlands, where the *Eucalyptus odorata*-*E. oleosa* ecotone of the eastern slopes of the Murray Range ceases. My investigations on the plants of the area commenced in 1929, and have been carried out only as subsidiary to other work in natural history. I am pleased to acknowledge assistance received from several botanists in the identification of some of the species. I am indebted to Messrs. J. M. Black, E. W. Pritchard, W. C. Johnston, and G. H. Clarke for their assistance in the identification of some of the plants listed.

The total number of species listed here is 283, representing 170 genera and 48 families. Introduced plants are marked with an asterisk.

Pinaceae.—*Callitris glauca*, *C. propinqua*.

Gramineae.—*Cymbopogon exaltatus*, *Panicum decompositum*, *Paspalidium gracile*, **Echinochloa crus-galli*, **Phalaris minor*, *Stipa nitida*, *S. platychaeta*, *S. eremophila*, *S. elegantissima*, **Polypogon monspeliensis*, *Calamagrostis filiformis*, **Avena fatua*, **A. barbata*, *Danthonia semiannularis*, **Lamarckia aurea*, **Koeleria phleoides*, **Schismus barbatus*, **Poa bulbosa*, **P. annua*, **Festuca bromoides*, **F. myosurus*, **F. rigida*, **Bromus villosus*, **B. hordeaceus*, **B.*

rubens, **B. madridensis*, *B. arenarius*, **Lolium* spp., **L. temulentum*, *Lepurus incurvatus*, *L. cylindricus*, **Hordeum murinum*.

Juncaceae.—*Juncus bufonius*.

Liliaceae.—*Dianella revoluta*, *Anguillaria dioica*, *Lomandra dura*, *L. effusa*, *Thysanotus Baueri*, *Bulbine bulbosa*, *Dichopogon fimbriatus*, *Asphodelus fistulosus*.

Iridaceae.—**Moraea xerospatha* var. *monophylla*.

Casuarinaceae.—*Casuarina cristata* (Syn. *C. lepidophloia*), *C. stricta*.

Urticaceae.—*Parictaria debilis*, *Urtica urens*.

Proteaceae.—*Hakea leucoptera*, *Grevillea Huegelii*.

Santalaceae.—*Exocarpus aphylla*, *Eucarya acuminata*, *E. Murrayana*.

Loranthaceae.—*Loranthus exocarpi*, *L. Preissii*, *L. Miquelii*.

Polygonaceae.—**Polygonum aviculare*, **Rumex pulcher*.

Chenopodiaceae.—*Rhagodia baccata*, *Rh. parabolica*, *Rh. Preissii*, *Rh. Gaudichaudiana*, *Rh. spinescens*, *Rh. crassifolia*, *Rh. nutans*, *Chenopodium cristatum*, **Ch. murale*, *Atriplex stipitatum*, *A. velutinellum*, *A. vesicarium*, *A. semibaccatum*, *A. prostratum*, *A. Muellieri*, *A. campanulatum*, *A. spongiosum*, *Bassia uniflora*, *B. scilerolaenoides*, *B. paradoxa*, *B. obliquicuspis*, *B. patentiscuspis*, *Kochia brevifolia*, *K. pyramidata*, *K. tomentosa* var. *appressa*, *K. tomentosa* var. *humilis*, *K. sedifolia*, *K. Georgei*, *K. aphylla*, *K. triptera* var. *erioclada*, *Sal-sola Kali*, *Enchylaena tomentosa*, *Arthro-nemum halocnemoides*.

Amaranthaceae.—*Trichinium obovatum*, *T. spathulatum*.

Aizoaceae.—**Cryophytum crystallinum*, *Car-pobrotus aequilaterus*, *Tetragonia ex-pansa*.

Caryophyllaceae.—**Cerastium glomeratum*, *Spergularia rubra*, **Silene nocturna*.

Ranunculaceae.—*Clematis microphylla*.

Lauraceae.—*Cassytha pubescens*.

Papaveraceae.—**Papaver dubium*, **P. hybridum*, **P. somniferum* var. *setigerum*, **Fumaria parviflora*, **F. muralis*.

Cruciferae.—**Sisymbrium erysimoides*, **S. orientale*, *Blennodia trisecta*, *Geococcus pusillus*, **Diploaxis muralis* var. *Babingtonii*, *Alyssum linifolium*, *Lepidium leptopetalum*, *L. hyssopifolium*, **Cap-sella Bursa-pastoris*, *Hutchinsia procumbens*, *Stenopetalum lineare*, **Rapistrum rugosum*.

Resedaceae.—**Reseda luteola*.

Crassulaceae.—*Crassula Sieberiana*.

Pittosporaceae.—*Pittosporum phillyreoides*, *Bursaria spinosa*.

Leguminosae.—*Acacia obliqua*, *A. microcarpa*, *A. argyrophylla*, *A. ligulata*, *A. notabilis*, *A. calamifolia*, *A. Sclerophylla* var. *lissophylla*, *A. Oswaldii*, *A. Menzeli*, *A. colletioides*, *Cassia Sturtii*, *C. eremophila*, *C. eremophila* var. *platypoda*, *Templetonia egena*, **Trifolium tomentosum*, **T. arvense*, **Melilotus indica*, **M. alba*, **Medicago sativa*, **M. tribuloides*, **M. denticulata*, **M. apiculata*, **M. confinis*, **M. minima*, *Lotus australis* var. *parviflorus*, *Psoralea patens*, *Swainsona laxa*, **Vicia sativa*, *Glycine clandestina*.

Geraniaceae.—*Geranium pilosum*, *Erodium cygnorum*, **E. botrys*, **E. moschatum*, **E. cicutarium*.

Oxalidaceae.—*Oxalis corniculata*, **O. cernua*.

Zygophyllaceae.—*Nitraria Schoberi*, *Zygophyllum apiculatum*, *Z. Billardieri*, *Z. ammophilum*, *Z. crenatum*, *Z. ovatum*, *Z. idiocarpum*, *Z. fruticosum*.

Rutaceae.—*Geijera linearifolia*, *Microcybe multiflora*.

Euphorbiaceae.—**Ricinus communis*, *Euphorbia Drummondii*, *Beyeria Leschenaultii* var. *rosmarinoides*.

Sapindaceae.—*Heterodendron oleifolium*, *Dodonaea viscosa*, *D. attenuata*, *O. cuneata*, *D. Baueri*, *D. stenozyga*, *D. tenuifolia*.

Malvaceae.—*Lavatera plebeja*, *Malva parviflora*, *Plagianthus glomeratus*, *Sida corrugata*.

Thymelaeaceae.—*Pimelea serpyllifolia*, *P. simplex*.

Myrtaceae.—*Melaleuca pubescens*, *Eucalyptus odorata*, *E. oleosa*, *E. incrassata*, *E. gracilis*.

Halorrhagidaceae.—*Halorrhagis elata*, *Myriophyllum Muellieri*.

Umbelliferae.—**Bupleurum semicompositum*, **Torilus nodosa*, **Conium maculatum*, **Foeniculum vulgare*.

Primulaceae.—**Anagallis arvensis*, **A. femina*.

Gentianaceae.—**Erythraea Centaurium*.

Convolvulaceae.—*Convolvulus erubescens*.

Borraginaceae.—*Halgania cyanea*, *H. lavandulacea*, *Heliotropium europaeum*, *Lappula concava*, **Lithospermum arvense*, **Echium plantagineum*.

Verbenaceae.—**Verbena supina*.

Labiatae.—*Teucrium racemosum*, **Marrubium vulgare*, **Salvia Verbenaca*, *Prostanthera striatiflora*, **Stachys arvensis*.

Solanaceae.—*Solanum nigrum*, *S. simile*, **Lycium ferocissimum*, *Nicotiana maritima*, **N. glauca*.

Myoporaceae.—*Myoporum montanum*, *M. platycarpum*, *Eremophila oppositifolia*, *E. longifolia*, *E. alternifolia*, *E. glabra*, *E. scoparia*.

Plantaginaceae.—*Plantago varia*, **P. lanceolata*.

Rubiaceae.—**Sherardia arvensis*, *Galium umbrosum* var. *muriculatum*, *Asperula scoparia*.

Cucurbitaceae.—**Citrullus vulgaris*, **Cucumis myriocarpus*.

Campanulaceae.—*Wahlenbergia vinciflora*.

Goodeniaceae.—*Goodenia pinnatifida*, *Scaevola spinescens*.

Compositae.—*Brachycome debilis*, *B. ciliaris*, *Minuria leptophylla*, *Calotis hispidula*, *Vittadinia triloba*, *V. tenuissima*, *V. megacephala*, *Olearia primeleoides*, *O. magniflora*, *O. Muellieri*, *M. calcarea*, **Xanthium spinosum*, *Centipeda Cunninghamii*, *Erechthites quadridentatus*, *Senecio brachyglossus*, *O. lautus*, **Calendula arvensis*, **Cryptostemma calendula-ceum*, *Cratystylis conocephala*, *Pterocaulon sphacelatum*, *Cassinia arcuata*, *Helipterum polygalifolium*, *H. Jessenii*, *H. pygmaeum*, *H. corymbiflorum*, *Ixiolaena tomentosa*, *Helichrysum leucopodium*, *H. apiculatum*, *H. semipapposum*, *Podolepis acuminata*, *Athrixia tenella*, **Inula graveolens*, *Angianthus pusillus*, *Gnaphalodes uliginosum*, *Craspedia uniflora*.

(Continued at foot of next page.)

Our Little-known Birds

By

H. T. CONDON.

As it is unlikely that many new species of birds will be discovered in the future in Australia, it is a popular conception that everything is known about our birds. Nothing could be further from the truth. In a land where birds form such a prominent feature of the landscape, it is surprising that, with the exception of a few enthusiasts, an apathetic attitude is adopted towards any *organised* study, so that after 150 years of colonisation we are still very far from elucidating the mysteries of their origins, relationships, occurrence, and economic importance.

In Australia occur some of the most obscure of birds; many of them are as rare as the rarest of gems. It should be noted, however, that the term "rare" should not be applied to many, as this gives an impression of smallness of numbers, whereas all that is implied is that they are rarely met with.

Nevertheless, it is a fact that several birds may rightly claim the distinction of being "rare." Foremost of these is the subject of our cover picture, the Black-throated Whipbird (*Psophodes nigrogularis leucogaster*), which was not discovered in this State until 1936⁽¹⁾. It is called the Whipbird because its closest relative is the Coach-Whip Bird (*Psophodes olivaceus*) of Eastern Australia, and famous for its loud "whip crack" call-note, which is not made by the Black-throated species however. A Western Australian variety was first discovered in the Wongan Hills, Western Australia, nearly 100 years ago (about 1844). Seventy-six years later, another sub-species was discovered in what is now known as the "Murray mallee," at Panitya, Victoria (north-east of Pinnaroo, South Australia). Twelve years later, the first Victorian bird was collected, the skin now being in the Melbourne Museum. Since then two examples have been collected near Pinnaroo in this State, one of which forms the subject of the coloured illustration.

Until recently one of the least known of our

birds was the Scarlet-breasted Parrot (*Neophema splendida*), which lives in the interior of Western and South Australia, and New South Wales. Within the last decade a few examples have been captured and these have been bred in captivity. By 1936 this species had become quite a common aviary bird, though still a rarity in the wild. Two years later the birds were discovered in incredibly large numbers in the interior of South Australia. Scores were taken at their nests and sent to several places. In October, 1938, one Adelaide "bird shop" sold at least nine pairs for £8/8/- per pair. Soon after, owing to the large numbers offering, the price dropped to £2/5/- per pair. Despite the vigilance of the Fisheries and Game Department, it is authoritatively stated that at least between five and six hundred birds were illegally smuggled out of the State in January, 1939. Another little-known parrot is the Ground Parrot (*Pezoporus wallicus*), a denizen of the coastal swamp-lands of Southern Queensland, New South Wales, Victoria, Tasmania, south-east of South Australia, and south-western Australia. Only three examples are at present known to be in captivity, and all are in the Adelaide Zoo.

Another rarity is the little Plain Wanderer (*Pedionomus torquatus*), which lives unostentatiously on the plains to the north of Adelaide, and on Yorke Peninsula. Of somewhat quail-like appearance and habits, its presence is usually only brought to notice when it is accidentally shot by quail-shooters. Records of its nest and habits are few, although there is a recent one from Maitland, Yorke Peninsula⁽²⁾. In this species the female is larger and brightly coloured, while the male, who is said to look after the young, is hardly ever seen.

(1) South Australian Ornithologist, XV, 2, p. 19 (1939).

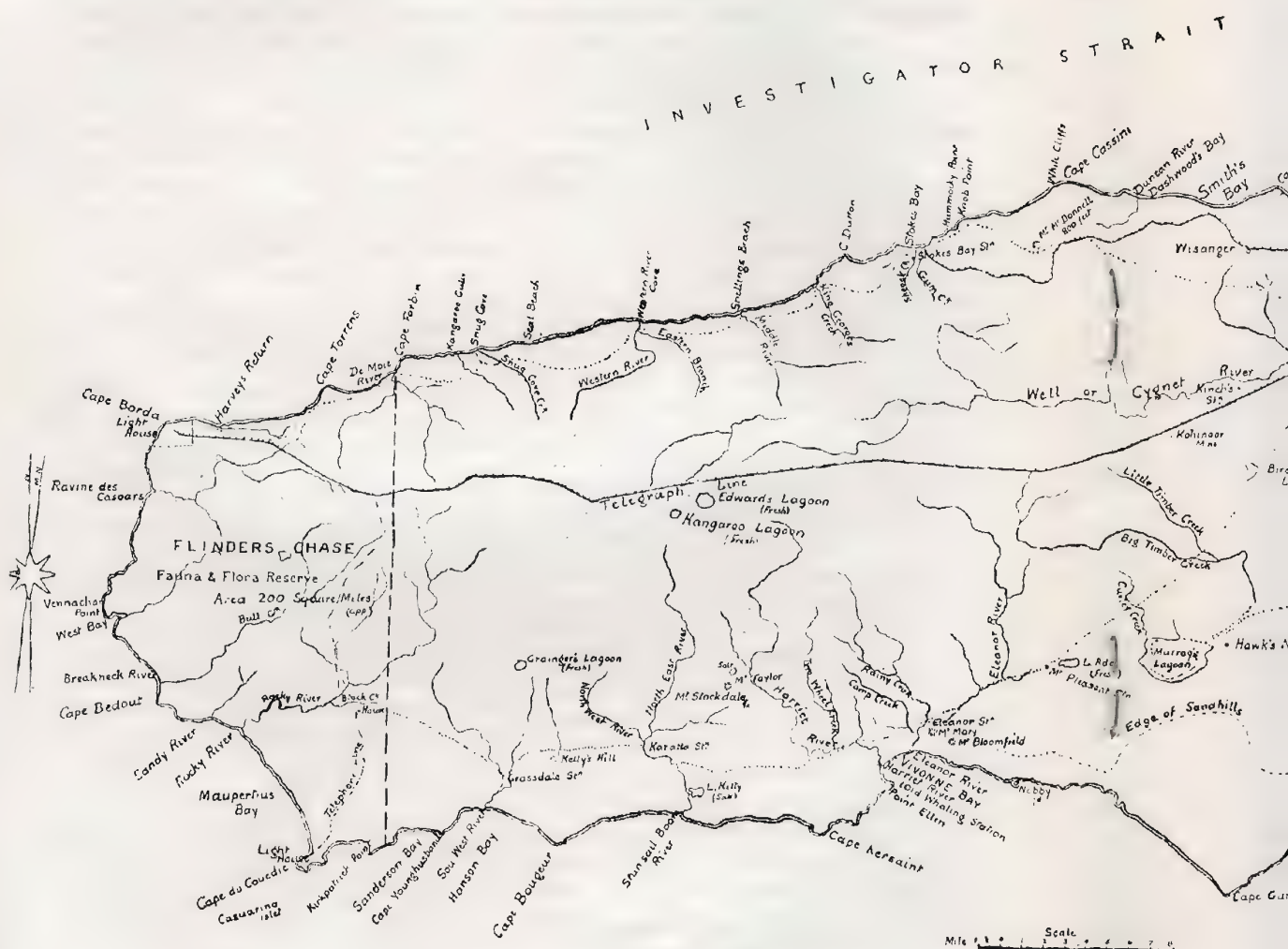
(2) Emu, XXXVIII, p. 327 (1938).

[Color plate of Whipbird loaned by S.A. Ornithological Association.]

**Cynara Cardunculus*, **Carduus tenuiflorus*, **Silybum Marianum*, **Onopordon Acanthium*, **O. acaule*, **Centaurea solstitialis*, **C. melitensis*, **C. Calcitrapa*,

**Carthamus lanatus*, **Hedypnois cretica*, **Hypochoeris glabra*, **Scorzonera laciniata*, **Leontodon hirtus*, **Sonchus oleraceus*, **S. asper*.

The LAND SHELLS of KANGAR



The terrestrial fauna of any island must always form an interesting subject of study, particularly is this so in the case of land shells with their limited means of dispersal and consequent tendency to form very restricted communities. The extent of individual

colonies is strictly decided by geological formation and ecological factors. Ecological variations have proved very interesting, as the variants may be (a) dependent upon local ground conditions (geodecols), or (b) produced by climatic changes (horeocols).

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KANGAROO ISLAND

By
Bernard C. Cotton

Previous to the publication of "The Land Shells of South and Central Australia," by Iredale, in this periodical (Vol. XVIII, No. 2, p. 6-59), only five species of land shells had been recorded from Kangaroo Island, and three of these are still known only from

there. Iredale's list added four species, and the present list adds five more, two of which are new. For most of these interesting finds we are indebted to H. M. Cooper, who has continued his effective collecting trips, first mentioned in Vol. XX, No. 1, of this

publication, by a preliminary investigation of Kangaroo Island.

FAMILY VERTIGINIDAE.

Australbinula margaretae, Cox, 1863.

Type locality, Wallaroo, South Australia.

Three specimens from Cape Cassini (Cooper).

Themapupa adelaidae, Angas, 1865.

Type locality, Adelaide, South Australia.

Six specimens of this species were taken at Vivonne Bay. It is widely distributed on the mainland.

Omegapilla australis, Angas, 1864.

Type locality, Rapid Bay, South Australia.

Vivonne Bay (Cooper).

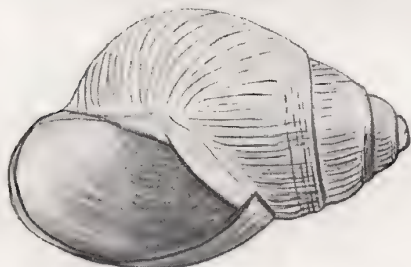
FAMILY SUCCINEIDAE.

Succinea australis, Ferussac, 1821.

Type locality, Kangaroo Island, South Australia.

Hog Bay, Cape Hart, Emu Bay, Rocky River, Antechamber Bay, Pennington Bay.

FAMILY BOTHRIEMBRYONTIDAE.



Bothriembryon decresensis, sp. nov.

Holotype, Cape Cassini, Kangaroo Island (D. 13773, S.A. Mus.), height 16 mm., width 10 mm.

Shell imperforate, ovately conical, axially irregularly plicate and spirally linearly furrowed just below the suture; colour, yellowish-brown with no other colour ornamentation; adult whorls three, the body whorl four times the height of the spire; aperture slightly oblique, peristome simple, columella slightly thickened, protocond of one and a half whorls of a distinctly finely wrinkled texture. Compared to the mainland species *mastersi*, *decresensis* is smaller, narrower, thinner, less colored, and shows no indication of spiral banding, a feature which is so characteristic of *mastersi*. Specimens showing at least distinct subspecific differences from *mastersi* are in the South Australian

Museum collection from Thistle Island, Rabbit Island, Spilsby Island, and St. Francis Island.

No species of the family *Bothriembryontidae* has hitherto been recorded from Kangaroo Island, but numerous specimens of this species were taken at the type locality by H. M. Cooper.

FAMILY XANTHOMELONTIDAE.

Pleuroxia lemani, Gude.

Type locality, Cape Borda, Kangaroo Island. No specimens of this species have been obtained to our knowledge by any collector since the original specimens were taken.



Notobadistes cooperi, sp. nov.

Holotype, Stunsail Boome (Cooper) (D. 13797, S.A. Museum), height 14 m.m., diameter 16 mm.

Shell medium sized, globose, white, sculpture of indefinite, irregular, coarse axials, and peculiar secondary sculpture of regular, fine spiral striae on the lower part of the body whorl; umbilicus small, partly hidden by the reflected columella; outer lip slightly reflected; protocond of one and a half apparently smooth but actually faintly granulose whorls, this sculpture being visible under an $\times 10$ pocket lens; adult whorls three. The species somewhat resembles *Notobadistes nullarboricum*, from Bunda Plateau, Nullarbor Plain, but differs in the smaller size and coarser sculpture.

Glyptorhagada bordaensis, Angas.

Type locality, Cape Borda, Kangaroo Island. Cape Willoughby, Rocky River (Cooper).

(Continued at foot of next page.)

Rejuvenation of Vegetation After the Bushfire in the National Park, South Australia

By

J. B. CLELAND, M.D.

In the second week of January, 1939, near the end of the record Australian heat-wave, during which the shade temperature at Adelaide was over 100 degrees F. for nine days out of the first fourteen in the month, and the Adelaide shade record of 117.7 degrees F. was attained, fanned by a hot dry north wind, an extensive bushfire swept through the eastern part of the National Park. In spite of numerous helpers, much damage was done before any control could be obtained. During its progress, the beautiful Japanese cherry plantation was almost completely destroyed. Onlookers described the progress of the fire as a terrifying spectacle. The flames ascended the trunks of the Stringybark Eucalypts by the fibrous and frayed outer fragments of the bark, which readily became detached and were carried by the fierce wind up hillsides and across valleys, dropping sparks on the way and spreading the fire ahead when they landed. In places the fire swept aloft from tree to tree, the heat being apparently sufficient to volatilise the inflammable essential oil so that this itself caught fire in mid-air by adding fuel to the furnace. Mr. C. P. Hodge, the secretary and curator of the National Park, describes three distinct zones of fire—an advanced one of burning vapor about a chain ahead of the fire raging through the tree tops, which itself was about a chain in front of the fire advancing on the ground level. When the fire was over, the area affected—hillsides, valleys and creek-beds—was destitute of living leaves and bare of vegetation, except for the blackened

leaf-less trunks of trees and the dead stems of the stouter plants. Old dead stumps of forest trees smouldered on and were nearly consumed till put out by the rain that came with the end of the heat-wave. The scene was one of desolation. The intensity of the heat and the fierceness of the conflagration made one wonder whether it was possible for regrowth and re-seeding to take place except after a period of many months.

The hot dry summer was followed, however, by an unusually wet winter, with many days of rain, and an official Adelaide total of 23.29 inches (average 21.17 inches). Soon after the first showers, the eucalypts began to show their leaves and, as winter passed, vegetation appeared again. An accidental visit to the burnt area at the end of December, 1939, just under a year since the fire had occurred, showed a phenomenal growth. So striking in places was the rejuvenation that a record was at once commenced over the southern portion of the burnt area of the species of plants present. This was supplemented at the beginning of January by an examination of a more northern part. The present paper is to place on record the results obtained. It is not a planned ecological study of "pyric succession," as in the account of Jarrett and Petrie on the vegetation of the Black's Spur region in Victoria. It was not realised till nearly a year after the fire had occurred what an opportunity had been missed for a similar study in our Adelaide hills district.

FAMILY LAOMIDAE.

Paralaoma (Insullaoma) decreasensis, Iredale, 1937,

Holotype, Kangaroo Island, (D. 3232, S.A. Mus.).

Excellaoma neta, Iredale, 1937.

Holotype, Kangaroo Island (D. 13769, S.A. Mus.).

FAMILY HADRIDAE.

Exilibodistes sutilosa, Deshayes, 1850.
Type locality, St. Peter's Island.

Hog Bay, 4 miles west of False Cape, Vivonne Bay, Ravine des Casoars, Stunsail Boome, Enu Bay, Cape Hart, Rocky River, Antechamber Bay. Numerous specimens were taken by H. M. Cooper at all these localities. Prof. Harvey-Johnston took specimens at Kelly's Hill Caves.

Cupedora tomsetti, Tate, 1887.

Holotype, Cape Borda, Kangaroo Island (D. 13594, S.A. Mus.).

Hundreds of specimens taken at Snug Cove and Cape Borda by H. M. Cooper.

The portion burnt and examined in this survey is almost entirely Stringy-bark (*Eucalyptus obliqua*) forest. Most of the plants here recorded and referred to later were noted on the lower slopes of the northern and shaded side of the upper end of Long Gully. Here the Stringy-barks were interspersed with Manna Gums (*E. viminalis* s.l., probably *E. Hubertiana*) and a few Blackwoods, the Stringy-barks dropping out at the bottom of the valley, but being the predominating tree further up. The Manna Gums seem more sensitive to fire than the other three species of Eucalypt in the area, as some trees seem to have been killed, and others, after throwing out a few shoots had apparently succumbed. On the crest of the hill, the trees were more open and *E. leucoxylon* and *E. fasciculosa* were mixed with the Stringy-barks; being grazed by sheep and drier, the number of under-shrubs was few and no notable additions were made to the list. On the northern slopes of this hill, scattered *E. leucoxylon* was the only tree; exposure to the sun and the grazing had allowed very few shrubs and smaller plants to develop, an occasional *Bursaria* being the only important addition. However, in the narrow watercourse, where shade and a more fertile soil made conditions more suitable, a number of plants were growing, as along the lower slopes of Long Gully. In one portion, situated above Long Gully Station, the Stringy-barks in a pure stand were dense and close together on a steep shady hillside; here the forest floor was still very bare, though, with a number of scattered plants of bracken, *Viola hederacea*, *Hibbertia acicularis* var. and *Acrotriche fasciculiflora* and a few examples of *Acaena*, *Erythraea* and *Hydrocotyle*. In and near the watercourse draining this area, *E. viminalis* was mixed with Stringy-bark, and a dense undergrowth had developed, the vegetation again being like that in Long Gully. Ascending the opposite and more sun-exposed slope, *E. leucoxylon* soon replaced *E. viminalis*. Dense Stringy-bark forest again occurred above this slope in an undulating area forming one of the highest parts of the Park. The only change to be noted was the abundance in the more open parts of *Dichopogon strictus* and of seedlings of *Acacia myrtifolia*, and in fewer numbers of *Pultenaea daphnoides*. Again in the shallow watercourses of this area, the vegetation was very luxuriant.

A very open area near here showed scattered Pink Gums (*E. fasciculosa*) and a few Stringy-barks.

It will be seen from this general description that the survey comprises a Stringy-bark (*E. obliqua*) forest, in parts forming a pure stand, but with little undergrowth, most of the plants recorded being found in the lowermost slopes and near the watercourses, where Manna Gums were usually intermixed with the Stringy-barks. In the list of plants appended, those that were numerous are indicated. In the text a few species are mentioned of which only one or two examples were seen. The other plants were scattered in their distribution.

The eucalypts, as expected, had vigorously sprouted from the butts and larger branches, and were well covered with leaves. Fortunately the mistletoes, mostly *Loranthus Miquelii* on *Eucalyptus leucoxylon* and *E. fasciculosa*, but also *L. pendulus* on the Stringy-bark (*E. obliqua*), had all been destroyed. They seem very sensitive to the heat of a fire. On one Blue Gum (*E. leucoxylon*) no less than 36 dead mistletoes were counted, and on another 19. The trees themselves were recovering. Blackwoods, Native Cherries, gorse, *Acrotriche fasciculiflora*, and other small trees and shrubs with butt-like bases were growing freely from the ground level. A vast company of herbs, grasses, undershrubs, and ephemerals were jostling each other for room and for light on the lower parts of the steeper hills, and in the rich soil of the narrow valleys and along the courses of the winter streams. The individual plants were unusually luxuriant and the rank growth reached the knees or higher. The ground was so covered that the soil could not be seen till one ascended the hill-sides, when the growth became more open.

Plants that one knew as denizens of the Park normally only a few inches high (e.g., *Hydrocotyle laxiflora*), were here four times that size. The fire had made an excellent seed-bed and forcing ground. It had sterilised extensively the actual surface, and had burnt up all loose surface seeds, and the ash had supplied an abundance of salts for plant food. The soluble constituents had to some extent been leached down to the lower levels, where also on the southern aspects the mois-

ture had been largely conserved. There had been as it were a rush to occupy the vacant spaces, seedlings from buried and wind-borne seeds competing with such perennial plants as had survived by their roots or by means of bulbs or other subterranean devices. Including the trees, approximately 143 species of plants, 48 of them introductions, were found struggling for survival against each other in this burnt area. Some, mostly annuals, were in great abundance, but in a few cases one or two plants only were seen, apparently the result of wind dispersal of their seeds. These included three species not previously recognised in the Park—three seedlings of *Solanum aviculare*, one plant of *Torilis nodosa* and one of *Stylidium graminifolium*. Some points of special interest in connection with the distribution of the plants may be noted. It has already been mentioned that the density of the growth became less as one ascended the hillsides, where the ground was more exposed and was also more leached. Owing to exposure to the sun, the northern slopes were also less densely covered than those facing south. However, undulating upland country north-east of Long Gully Station showed a considerable covering of plants, but the surfaces here were gently sloping and transversed by superficial water-channels, dry in summer. Here, in the spring, growing amongst the trees, there had been large numbers of the Liliaceous plant, *Dichopogon strictus*, which presents a very open appearance with its loosely arranged, spreading branches and vanilla-scented purple flowers. In the southern portion of the burnt area, sheep had been depastured in an attempt to reduce the undergrowth with its danger of fire in summer if left. It was of interest to find that the sheep had, as yet, left almost untouched the rank vegetation on the lower slopes and in the valleys, finding it probably too long for them. Instead, they had fed almost entirely on the hill-tops, where they had in places almost eaten out the growth and had even cropped closely harsh native shrubs that were rejuvenating from their bases. The contrast between this part of the burnt area and that untouched by sheep north of the fencing running over the Long Gully tunnel was striking. This cropping had been so close that there is danger of erosion; also there may be difficulty in the perennials re-

juvenating from their root-stocks if continually eaten back. Sheep, in taking to the higher parts of their feeding area, probably exhibit an ancestral trait. It would also seem that they are not really suitable pasture animals for our hills districts.

Many years ago, probably before the Park was gazetted as the National Park, very large Stringybarks and other eucalypts had been cut down. The stumps of these still remain. Those in the burnt area naturally caught fire, but even so were not completely consumed owing to the rain that followed. Nevertheless, they had burnt for some time. Around them the ground was usually reddish and often bare or partly bare of plants. This lack of vegetation may be due to the prolonged heat of the fire killing those plants whose roots elsewhere had survived the short-lived passing flames. Probably also it had killed seeds buried but near the surface which had survived elsewhere to germinate in the winter. There were several rather interesting features round these burnt stumps. On such bare areas, and some similar ones a few yards in diameter, but not apparently associated with old stumps, a considerable growth of the liver-wort *Marchantia polymorpha*, and of the common Cord Moss (*Funaria hygrometrica*) that often follows a bush fire, had occurred. Also in the crevices at the base of the inside of the stumps a number of young plants of bracken fern were coming up, the prothallus probably finding a suitable nidus in the ash, and no competition with other plants. In a few cases, luxuriant colonies of *Viola hederacea*, up to 15 x 6 inches in size, were a striking feature on the otherwise bare ground.

The most abundant plants, though not always abundant over the whole area, were the following:—The native grass *Microlaena stipoides* and the introduced one, *Aira caryophyllaea*; the Liliaceous *Dichopogon strictus*; the Mouse-ear Chickweed *Cerastium glomeratum*, much more abundant than the ordinary Chickweed (*Stellaria media*), on the lower southern slopes; seedlings of the pea *Pultenaea daphnoides* and of the scrub wattle (*Acacia myrtifolia*) in the highlands to the north-east of Long Gully Station, where also the small Euphorbiaceous plant, *Poranthera microphylla*, the introduced St. John's Wort

(*Hypericum perforatum*), the native *H. gramineum*, the Lesser Loosestrife (*Lythrum hyssopifolia*), the introduced Centaury (*Erythraea centaurium*), *Dichondra repens* (a prostrate creeping and rooting Colvolvulaceous plant), and the alien Rooted Cat's-Ear (*Hypochoeris radicata*) were common. In the rank vegetation of the lower southern slopes were Hop Clover (*Trifolium procumbens*—introduced), *Hydrocotyle laxiflora* (Umbelliferae), with very large leaves, and Field Madder (*Sherardia arvensis*), another alien. In a creek bed, the Milk Thistle (*Silybum Marianum*—introduced) grew up to nine feet in height.

Four ferns were growing in the area, probably from their rhizomes, though there were a number of young plants of bracken. There were 18 grasses, of which 12 were introductions. Three of the native grasses, Kangaroo Grass (*Themeda triandra*), *Microlaena* and *Poa caespitosa* were perennials and probably grew from old roots. The same probably applies to the two Wallaby grasses (*Danthonia*). The other 13 were annuals, 12 of them aliens, and only one native (*Calamagrostis filiformis*), whose seed had either blown there since the fire or had been covered by humus and so protected. There were no Spear Grasses (*Stipa* sp.), but this habitat is not very suitable for them. Of the six sedges, five were small annuals and the other, *Carex inversa*, was a perennial.

The two species of *Centrolepis* are annuals. Of the six rushes, probably only one (*Juncus pauciflorus*) had grown from root stocks. In the Liliaceae, the Grass-tree (*Xanthorrhoea*) grew from its base, *Lomandra glauca* and *Bulbine* probably from roots, and *Burchardia*, *Tricoryne* and *Dichopogon* presumably from seeds. Only two orchids were noted (December), but doubtless others had come up earlier. The *Banksia* seemed to be regrowing from suckers near the burnt stem. The Native Cherry grew from its base. The Docks (*Rumex*), the three Caryophyllaceae, the two *Ranunculi*, the *Cardamine*, the *Drosera*, and the two *Crassulae*, all grew from seed. Bursaria, Sweetbriar, Blackwood and Gorse grew again from their bases.

Acacia myrtifolia, the Golden Wattle, and the *Pultenaea daphnoides*, found an excellent seed bed. There were six clovers, Hop

clover being very abundant, one Medic and one Vetch—all introductions and, except *Trifolium repens*, seed distributed. The two Geraniums and *Oxalis* were seed plants; as was *Poranthera* (*Euphorbiaceae*), which was abundant in places. The Violet has already been mentioned as growing unusually well. *Hydrocotyle laxiflora* was abundant and also unusually large, and with the other four Umbellifers, seed distributed. *Torilis* was a new record for the Park, only one plant being found. The two Epacrids grew from roots.

The two Pimpernels and Centaury grew from seeds, the *Asclepias* and probably *Dichondra* and *Ajuga* from roots. It was a surprise finding three seedlings of *Solanum aviculare* (Kangaroo Apple), also a new record for the Park. *S. nigrum*, the Field Madder (*Sherardia*), which was abundant, the three Galiums, and the two Bluebells (*Wahlenbergia*), also had grown from seed. *Scaevola microcarpa* had rejuvenated from roots, and perhaps, so had the *Goodenia*. The *Brunonia* was probably from seed. There were 18 Composites, ten of them introductions, and all except perhaps the Cat's-ear, growing from seed. Six of the eight native Composites grew similarly, the remaining two, *Cymbonotus* and *Leptorrhynchus*, probably from roots.

Thus about 101 of the 145 plants noted were probably growing from seed which had either been buried too deeply for the fire to affect or had been blown into the area after the fire had occurred. Unburnt scrub was not far from where the list of plants was made, but growth seemed equally abundant where such scrub was a quarter of a mile away. The unburnt scrub was not so situated that rain could have washed the seeds to the burnt area in general, though this could have happened in places. Mammals and birds could not have played any but an insignificant role in distribution. When the seed has a well-developed pappus for wind dispersal, as in the thistles, seeding of an area such as this can be readily understood. Very small seeds, like those of the Australian Bluebells, the Pimpernels, etc., can also probably be transported some distance by a strong wind. The seeds of *Solanum* are flattened and evidently, in the case of the Nightshade (*S. nigrum*) and of the Apple of Sodom, are dispersed with unusual ease. Apparently also the seeds of Clovers, Medics and Vetches are readily dis-

tributed, though it may be held that the growth of these plants was from seeds buried in the soil and not from outside the area. In the following list of plants noted an asterisk (*) indicates an introduced plant, and x that the plant concerned was abundant.

[The authors of the various species of vascular plants will be found in Black's "Flora of South Australia."]

MOSS:—*Funaria hygrometrica*.

LIVERWORT:—*Marchantia polymorpha*.

FERNS:—*Adiantum aethiopicum*, *Cheilanthes tenuifolia*, *Peridium aquilinum*, *Asplenium flabellifolium*.

GRASSES:—*Themeda triandra*, x*Microlaena stipoides*, *Calamagrostis filiformis*, x*Aira caryophylla*, **Avena* sp., **Holcus lanatus*, *Danthonia auriculata* and probably another species, **Briza maxima*, **B. minor*, *Poa caespitosa*, **Festuca bromoides*, **Bromus villosus*, **B. madritensis*, **B. hordeaceus*, **Brachypodium distachyum*, **Hordeum* (cultivated barley, one plant), **Lolium* sp.

SEDGES:—*Cyperus tenellus*, *Schoenus apogon*, *Scirpus cernuus* (probably), *S. antarcticus*, *S. inundatus*, *Carex* near *C. inversa*.

CENTROLEPIDACEAE:—*Centrolepis aristata*, *C. strigosa*.

RUSHES:—**Juncus capitatus*, *J. bufonus*, *J. planifolius*, *J. holoschoenus*, *J. pauciflorus*, *Luzula campestris*.

LILIACEAE:—*Burchardia umbellata*, *Lomandra glauca*, *Tricoryne elatior*, *Bulbine bulbosa*, x*Dichophogon strictus*, *Xanthorrhoea semiplana*, **Moraea xerospatha* var. *monophylla*.

ORCHIDS:—*Dipodium punctatum*, *Microtis porrifolia*.

PROTEACEAE:—*Banksia marginata*.

SANTALACEAE:—*Exocarpos cupressiformis*.

POLYGONACEAE:—*Rumex Brownii*, **R. acetosella*.

CARYOPHYLLACEAE:—x* *Cerastium glomeratum*, **Stellaria media*, **Silene Gallica*.

RANUNCULACEAE:—*Ranunculus lappaceus*, *R. parviflorus*.

CRUCIFERAE:—*Cardamine hirsuta*.

DROSERACEAE:—*Drosera auriculata* or *peltata*.

CRASSULACEAE:—*Crassula Sieberiana*, *C. macrantha*.

PITTOSPORACEAE:—*Bursaria spinosa*.

ROSACEAE:—**Rosa rubiginosa*, **Alchemilla arvensis*, *Acaena ovina*, *A. Sanguisorbae*.

LEGUMINOSAE:—x*Acacia myrtifolia* (seedlings numerous), *A. pycnantha*, *A. melanoxylon* (rejuvenation—the agaric *Schizophyllum commune* on the burnt butt); x*Pultenaea daphnoides* (seedlings), **Ulex europeus* (Gorse), x**Trifolium procumbens*, **T. dubium*, **T. repens*, **T. glomeratum*, **T. arvensis*, **T. angustifolia*, **Medicago denticulata*, *Lotus australis*, *Psoralea patens*, **Vicia sativa*, *Kennedyia prostrata*, *Hardenbergia monophylla*.

GERANIACEAE:—x*Geranium pilosum* var. *potentilloides*, x**G. molle*.

OXALIDACEAE:—*Oxalis corniculata*.

EUPHORBACEAE:—*Poranthera microphylla*.

DILLENIACEAE:—*Hibbertia acicularis* var. *sessiliflora*.

GUTTIFERAE:—x**Hypericum perforatum* (St. John's Wort), x*H. gramineum*.

VIOLACEAE:—*Viola hederacea*.

THYMELEACEAE:—*Pimelea* sp.

LYTHRACEAE:—x*Lythrum hyssopifolia*.

MYRTACEAE:—*Leptospermum scoparium* (regenerating), *Eucalyptus obliqua* (rejuvenating, a few seedlings), *E. viminalis* (some rejuvenating, some dead), *E. leucoxylon* (rejuvenating), *E. fasciculosa*.

OENOTHERACEAE:—*Epilobium* sp.

HALORRHAGIDACEAE:—*Halorrhagis tetragyna*.

UMBELLIFERAE:—x*Hydrocotyle laxiflora*, *H. callicarpa*, *Daucus glochidiatus*, **Torilis nodosa* (one plant), **Foeniculum vulgare* (Fennel).

EPACRIDACEAE:—*Astroloma humifusum*, *Acrotriche fasciculiflora*.

PRIMULACEAE:—**Anagallis arvensis*, **A. femina*.

GENTIANACEAE:—x**Erythraea Centaurium*.

ASCLEPIADACEAE:—**Asclepias rotundifolia* (rejuvenating).

CONVOLVULACEAE:—x*Dichondra repens*.

BORRAGINACEAE:—*Cynoglossum suaveolens*.

LABIATEAE:—*Ajuga australis*.

SOLANACEAE:—*Solanum aviculare* (three seedlings), **Solanum nigrum*.

SCROPHULARIACEAE:—**Verbascum virgatum*, *Gratiola peruviana*, *Veronica arvensis*.

RUBIACEAE:—*Opercularis varia*, x**Sherardia arvensis*, *Galium Gaudichaudii*, **G. divaricatum*, **G. murale*.

CAMPANULACEAE:—*Wahlenbergia vinciflora*, *W. Sieberi*.

GOODENIACEAE:—*Goodenia primulacea*, *Scaevola microcarpa*.

BRUNONIACEAE:—*Brunonia australis*.

STYLIDIACEAE:—*Stylidium graminifolium*.

COMPOSITAE:—*Lagenophora stipitata*, *Olearia ramulosa*, *Cotula australis*, **Soli-*

va sessilis, *Erechtites arguta*?, *E. quadridentata*, *Senecio hypoleucus*, *Cymbonotus Lawsonianus*, **Cryptostemma calendulaceum*, *Gnaphalium japonicum*, *Leptorhynchus squamatus*, **Inula graveolens* (one plant), **Cirsium lanceolatum*, **Carduus tenuiflorus*, **Silybum Marianus* (Milk Thistle), x**Hypochaeris radicata*, **Picris echioides*, **Sonchus oleraceus*, **S. asper*.

REFERENCE.

Jarrett, P. H., and Petrie, A. H. K., 1929, "The Vegetation of the Black's Spur Region. A Study in the Ecology of Some Australian Mountain *Eucalyptus* Forests. II. Pyric Succession." *J. of Ecology*, 17, 249.

Orchid Notes

By

HAROLD GOLDSACK.

At the South Australian Naturalists' Wild Flower Show, held on September 26, 1936, two very interesting orchids were noticed in the Monarto South School exhibit, arranged by Mr. W. Giles.

The first, *Prasophyllum occidentale*, Rogers, is a dwarf green-flowered plant. This orchid has previously been found only at Streaky Bay, from which locality the type forms were described by Dr. R. S. Rogers, who considered it a distinctly western plant. It is most interesting that this little orchid should span the barriers of distance and physiographic obstructions, and be found in another home at Monarto South. The distance from Streaky Bay to Monarto South is about 350 miles.

Another surprise was the discovery of *Thelymitra megaclyptra*, Fitzg. This is a very handsome plant, somewhat similar to *Thelymitra aristata*, Lindl., put with a much larger column hood. Some botanists consider this orchid to be a variety of *Th. aristata*, Lindl. (W. H. Nicholls, 1934, *Vic. Nat.*, 51, 153). However, the plant seen in the Monarto South collection was sufficiently distinct to be noticed in a vase of *Th. aristata*. Whether we call it a species under the name of *Thelymitra megaclyptra*, Fitzg., or label it as a variety of *Thelymitra aristata*, Lindl., we have to record the fact of this orchid's first appearance in South Australia. It is found at Ararat, Stawell, and The Grampians in Victoria, and also in New South Wales.

The following is a description of *Thelymitra megaclyptra*, Fitzg.

Plant of medium height. Leaf often withered at time of flowering. Flowers fairly large, lilac or pale blue. Mid lobe of column yellowish, smooth, and much inflated. Penicillate lobes not as high as crest of column. (FitzGerald, 1873, *Aust. Orchids*, vol. 1.)

In the May issue of the "S.A. Naturalist," 1940, a list of plants to be found about Melrose included several orchids. Their number can be added to as the result of a visit by some members of the R.A.O.U. to the locality on November 3, 1936. One of the party, Mr. J. R. Somerville, collected *Thelymitra longifolia*, Forst., and *Pterostylis pusilla*, Rogers, about halfway up Mount Remarkable. Dr. Rogers identified the plants for Mr. Somerville, who later very kindly forwarded me the specimens.

Melrose is the type locality for *Prasophyllum validum*, Rogers, so this species can be added to the list.

In a communication from Dr. Rogers, Mount Remarkable is given as a locality for *Pterostylis robusta*, Rogers.

Additional orchids recorded from Melrose are:

Pterostylis robusta, Rogers.

Pterostylis pusilla, Rogers.

Prasophyllum validum, Rogers.

Thelymitra longifolia, Forst.

The Field Naturalists' Section

EXCURSIONS

1940		
Sept. 14—Pelican Point.	Train, 1.10 p.m.	Shell Collecting Mr. W. G. Tucker
28—Lionsnell Gully.	Tram, 2 p.m.	Botany Miss C. M. Eardley
Oct. 5—Aldgate.	Train, 1.14 p.m.	Flora Mr. F. C. Payne
7—Eden to Blackwood.	Train, 9.40 a.m.	Orchids Mr. J. Ferries
19—Largs Bay North.	Train, 1.10 p.m.	Shells Mr. B. C. Cotton
26—Mylor (2/6)	Motor, 1.30 p.m.	Flora Mr. W. D. Wade
Nov. 2—Belair to Mitcham.	Train, 1.14 p.m.	General Dr. M. T. Winkler
9—Henley to Glenelg.	Tram, 1.30 p.m.	Beach Life Mr. G. Pattison
16—Paradise.	Tram, 2 p.m.	Ramble Mr. A. K. Beasley
23—Mt. Lofty.	Train, 1.14 p.m.	Quarries Mr. R. Sprigg
30—Blackwood.	Train, 1.14 p.m.	Cultivated Flora Mr. E. Ashby
Dec. 7—Brighton to Glenelg.	Train, 1.11 p.m.	Seaweeds Mrs. R. W. Edmeades
28—Outer Harbor.	Train, 9.5 a.m.	Mud Flat Life Mr. F. K. Godfrev

TRAM EXCURSIONS.—Meet in Grenfell Street, by T. & G. Building.

TRAIN EXCURSIONS.—Will members obtain their tickets and meet on the train.

MOTOR EXCURSIONS.—Meet at the Town Hall, Adelaide. Book with the Secretary or the Treasurer.

EVENING MEETINGS

1940.		1941.	
Sept. 17—"Ephemeral Plants"	Prof. J. B. Cleland	Feb. 18—"Conversazione, Lady Colton Hall, Y.W.C.A.	
Oct. 15—"Epacrids"	Mr. E. H. Ising	Mar. 18—"Color"	Mr. A. K. Newbery
"South Aus. Seaports"	Mr. F. C. Martin	"Simpson Desert Flora,"	Mr. R. L. Crocker
Nov. 19—Members' Exhibit Evening.		Apr. 15—"Goodenacaceae"	Dr. M. T. Winkler
		"Hills Flowers"	Mr. W. D. Wade

MALACOLOGICAL SOCIETY: Evening Meetings

1940.		1941.	
Sept. 2—"Pyrenidae"	Mr. B. C. Cotton	Mar. 3—"Trochidae"	Mr. B. C. Cotton
16—"Conchometry"	Mr. B. C. Cotton	17—"Land Snails"	Mr. W. M. Nielsen
Oct. 21—"Fossil Mollusca"	Mr. R. Sprigg	April 7—"Shells Through the Ages"	
Nov. 4—"Muricidae"	Mr. B. C. Cotton	Mrs. L. A. Elliott	
18—"Seaweeds"	Mrs. R. W. Edmeades	21—"Hydrozoa"	Mr. F. K. Godfrev
Dec. 2—"Volutidae"	Mr. F. Trigg	May 5—"Turridae"	Mr. B. C. Cotton
		19—"Corals"	Miss D. M. Matthews

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URCHINS



PAPER NAUTILUS

VOLUME 20, No. 4.
NOVEMBER 30, 1940.

Registered at the G.P.O.,
Adelaide, for transmission
through the post as a
periodical.

The South Australian NATURALIST

JOURNAL OF THE FIELD NATURALISTS' SECTION OF THE
ROYAL SOCIETY OF SOUTH AUSTRALIA.

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Sea Shore Shells Of South Australia

By

BERNARD C. COTTON AND FRANK K. GODFREY

(Conchologist and Honorary Assistant Conchologist, S.A. Museum)

Sea shore shells and snail shells are the vacated homes of certain soft-bodied animals, grouped under the name Mollusca (Latin *mollis*, meaning soft). Actually the shell is more than a home to the living creature, being part and parcel of its very self. Every mollusc, on emergence from the egg, bears a tiny, glassy shell. The soft animal parts and the shell develop together, and are so connected that an enforced separation means death.

Certain of the Mollusca, for example, the Sea Slugs, have no shell when full grown, although beginning life with a rudimentary shell, which does not develop. Others, such as the Cuttles, possess a shelly plate, which is imbedded in the soft mantle covering. This makes it clear, from the molluscan viewpoint, that an external shell is not of chief importance, although it may be of decided value as a shield to protect the soft body from the attacks of aggressive animals.

The Mollusca were very ancient inhabitants of the earth, and their fossil shells are found in geological strata, whose age in years sounds almost astronomical. At that very early time the shells of Limpets were not much unlike those which cover the Limpets to-day. Many groups of the Mollusca, however, have become extinct, or have undergone extensive modification during the long interval, and others have arisen.

In every habitable place, in water and on land, the Mollusca have become adapted to their environment and established themselves. Each zone of depth of the sea and its surface, the sea shore left dry by the tide twice daily, each river, pond, forest, desert, or mountain range, has a molluscan population. Fresh water tanks, cisterns, water meters, and horse troughs, yield their quota of pond snails, and flower borders know the presence of snails and slugs.

Reckoning as species, fossil and recent, 75 per cent. of the Mollusca are univalve, or have the shell in one piece, as Cowry, Sea Ear and Whelk. Twenty per cent. are bi-

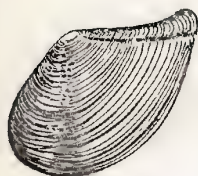
valve, the shell being in two pieces or valves, as Cockle and Oyster. The shell of Chiton has eight valves. When we reckon the Mollusca in terms of individuals we find that the bivalves lead.

In the larval stage, that period when separate existence commences, the young molluscs of the sea can keep afloat by means of waving hairy processes called cilia, and are borne to and fro by the tides and currents. Some species are free-swimming in this manner for only a very short time, and settle on the sea bottom, where they drop their larval characteristics and develop like their parents. These are largely littoral forms with a limited distribution. Other species remain afloat much longer, some even perhaps for days or weeks, and are carried great distances. The molluscan population variety of ocean islands is thus augmented by these tiny travellers. Myriads fail to arrive at a place suitable for their development and so perish, their fragile shells sinking and becoming part of a deposit forever increasing over the bed of the deep sea.

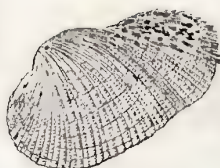
The molluscan shell is mainly composed of pure carbonate of lime, with a very slight proportion of phosphate of lime, and an organic base allied to chitin, known as conchiolin. The conchiolin forms a sort of membranous framework for the shell; it soon disappears in dead specimens, leaving the shell much more brittle than it was when alive.

Nacreous shells, such as Hammer Oyster and Sea Ear, are iridescent, due to a peculiar lineation of their surface, and are the least permanent. Porcellaneous shells, like the Southern Olive, will stand harder treatment. Most shells have a membranous structure. The Razor Shell is a rare form of cellular structure composed of a multitude of fairly regular hexagonal prisms.

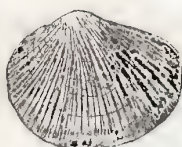
Beaches not far apart often vary considerably in the variety of shells found cast up. This is accounted for by the varying nature of the coast line below low tide mark. Sand,



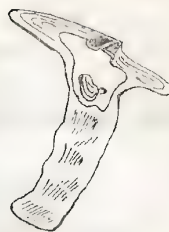
Beaked Cockle
Scaevola illepidia



Ark Shell
Sarbatia pistachia



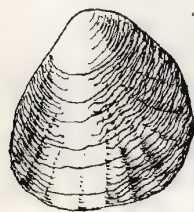
Dog Cockle
Glycymeris radians



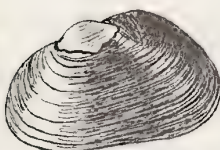
Hammer Oyster
Malilus meridionalis



Razor Shell
Pinna dolabrata



Port Lincoln Oyster
Ostrea sinuata



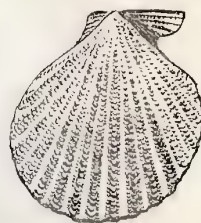
Murray Mussel
Hyriddella australis



Common Scallop
Notovola alba



Fan Shell
Equichlamys bifrons



Prickly Paa
Mimachlamys asperimus



Thorny Oyster
Spondylus tenellus



Perforated Oyster
Monia lone



Chestnut Mussel
Modiolus inconstans



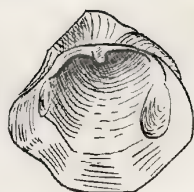
Horse Mussel
Modiolus areolatus



Black Mussel
Modiolus palex



Beaked Mussel
Brachydontes erosus



Rock Shell
Cleidothaerus albidus



Giant Cockle
Eurassatella verconis



Scale Ribbed Cockle
Cardita crassicastra



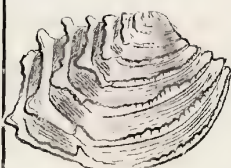
Rough Cockle
Chama ruderalis



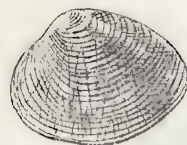
Heart Cockle
Cardium rackeetti



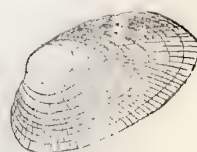
Wheel Cockle
Circe weedingi



Frilled Cockle
Callanaitis disjecta



Sand Cockle
Katylisia scalarina



Milk Stone Cockle
Venerupis galactites

rock, and weed, encourage and harbour different forms, and it is interesting to note during a walk of a mile or two how one predominant species gives way to another.

One of our collectors, with years of seafaring to his credit, points out that in stormy weather the beaches are swept by every tide, until the wind swings round and blows off-shore, when a lopping sea drops its load of weed and shell on to the beach. That is the time to get busy.

It is quite easy to collect 100 different species of shells from the beaches near Adelaide. If the quest be persisted in, say, from Outer Harbour to Marino Rocks, 300 species may be secured. Should the range be extended to include the ocean beaches of the State, the number may be brought to 500. The known species of shells in the waters and on land in South Australia total about 1,600. Many live in deep water, out of reach of most collectors, and storms fail to cast up their dead shells. To those who desire to limit the field, we recommend the sand spit and adjacent mud flats at Outer Harbour, next upstream from the Royal Yacht Squadron harbour, where probably 300 species may be listed.

The shells here described are those commonly brought to the South Australian Museum for identification.

The following lines were written more than 80 years ago by Professor Edward Forbes:—"To sit down by the sea-side at the commencement of ebb, and watch the shore gradually uncovered by the retiring water, is as if a great sheet of hieroglyphics—strange picture writing—were being unfolded before us. Each line of the rock and strand has its peculiar characters inscribed upon it in living figures, and each figure is a mystery, which, though we may describe the appearance in precise and formal terms, has a meaning in its life and being beyond the wisdom of man to unravel. How many and how curious problems concern the commonest of the sea-snails creeping over the wet seaweed? In how many points of view may its history be considered? There are its origin and development—the mystery of its generation—the phenomena of its growth—all concerning each apparently insignifi-

cant individual; there is the history of the species—the value of its distinctive marks—the features which link it with higher and lower creatures—the reason why it takes its stand where we place it in the scale of creation—the course of its distribution—the causes of its diffusion—its antiquity or novelty—the mystery (deepest of mysteries) of its first appearance—the changes of the outline of continents and of oceans which have taken place since its advent, and their influence on its own wanderings. Some of these questions may be clearly and fairly solved; some of them may be theoretically or hypothetically accounted for; some are beyond all the subtlety of human intellect to unriddle. I cannot revolve in my mind the many queries which the consideration of the most insignificant of organised creatures, whether animal or vegetable, suggests, without feeling that the rejection of a mystery, because it is a mystery, is the most besotted form of human pride."

Beaked Cockle. *Scaeoleda illepidia*.

The rostrum or beak is at the rear end and shows that the creature burrows deeply and remains buried for a long time. The fleshy siphons which convey water to aerate the gills have become longer in order to reach the water above, and the shell has become lengthened behind for their partial protection, there being otherwise insufficient room in the shell to withdraw the whole of the long siphons. The valves at this point do not fit closely, indicating that owing to the constant protrusion of the siphons, the edges of the shell cannot meet, there being always a slight gape. Shell colour, greenish grey. Common at Middleton. About one inch.

Ark Shell. *Barbatia pistachia*.

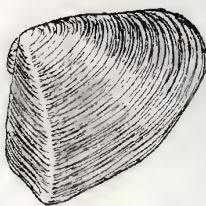
The rounded part is the front end. The numerous radial riblets and fine concentric grooves give a somewhat criss-cross appearance. The periostracum or covering is bristly, especially at the posterior end. Colour, brown, or whitish, faintly tinted with pale brown. The hinge teeth are small, in a straight row. Lives in holes and crevices of rocks. The name Ark is adapted from the group name *Arca*, which signifies a chest, from the supposed resemblance to Noah's Ark. Length, 2 inches.



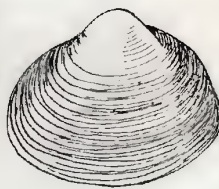
Sunset Shell
Tellina allinella



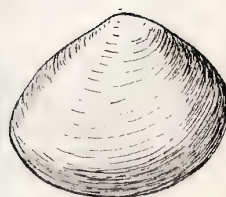
Double Rayed Sunset
Soletellina biradlata



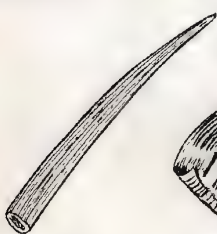
Goolwa Cockle
Plebidonax deltoides



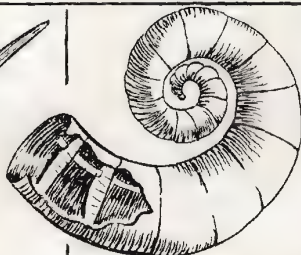
Southern Cockle
Macra australis



White Cockle
Macra pura



Tusk Shell
Dentalium bednalli



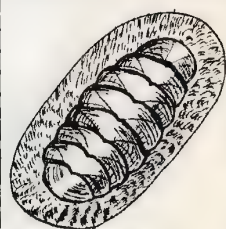
Post Horn
Spirula spirula



Squid Pen
Sepioteuthis australis



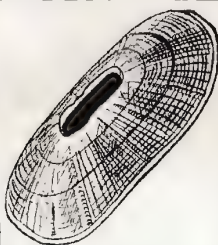
Cuttle Bone
Sepia novaehollandiae



Port Elliot Chiton
Poneroplax costata



Round Back Sea Ear
Haliotis cyclobates



Keyhole Limpet
Sopismalepas nigrita



Common Limpet
Cellana tramoserica



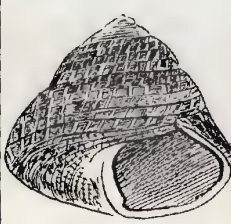
Hoop Shell
Thalotia conica



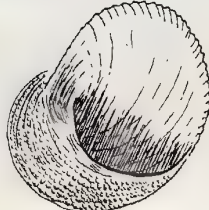
Ribbed Winkle
Austrocochlea torri



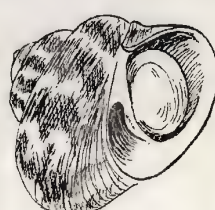
Wavy Winkle
Austrocochlea concamerata



Adelaide Winkle
Austrocochlea adelaidae



Granular Ear Shell
Stomatella imbricata



Common Warrener
Turbo undulatus



Heavy Top Shell
Turbo torquatus



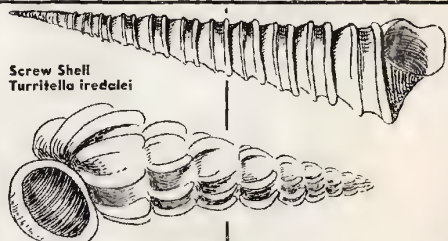
Pheasant Shell
Phasianella australis



Variegated Pheasant
Phasianella angasi



Black Crow
Nerita melanotragus



Screw Shell
Turritella irredalei



Wentletrap
Scala delicatula

Dog Cockle. *Glycymeris radians*.

Oval. Yellowish-brown, stained at the side with reddish or violet-brown. Hinge teeth numerous and small, in two series, one on each side of the umbo or beak. Gregarious, in sandy situations. Length, $1\frac{1}{2}$ inches.

Hammer Oyster. *Malleus meridionalis*.

The illustration depicts two wings or ears, and the one set at a lower level is at the rear end or posterior. Sometimes the front wing or the rear wing may be absent, for the shell is very variable. The animal lives anchored in sand by its byssus or fleshy root fibres (like the roots of a plant), which pass through a notch near the hinge line of the right valve. Interior pearly. Length, 4 inches.

Razor Shell. *Pinna dolabrata*.

The largest of our bivalves. Lives vertically, partially embedded by its apex in the soft bottom of sheltered bays, just below low tide mark, moored by the soft silky fibres of its byssus, which spread out in the sandy mud. The animal is good to eat; but it requires five or six hours' stewing, and then it is not so tender as a Scallop. Length, 8 inches or more.

Port Lincoln Oyster. *Ostrea sinuata*.

Sold in shops for food. It is said to be in prime condition from the fourth to the seventh year, and rarely to live beyond its fifteenth year. An oyster of one inch is about one year old, it increases annually by one inch until about the fifth year; subsequent age is indicated by thickening of the shell, the shelly deposit being added next to the animal parts. The flat top is the right valve. About 4 inches.

Murray Mussel. *Hyridella australis*.

Probably the principal food of the River Murray natives, as evidenced by the accumulation of shell on the river banks. The shell substance is pearly under a heavy periostracum, and when the latter has disappeared by weathering, the shell heaps are visible at a mile or more, glistening in the sunshine. Length, 3 inches.

Common Scallop. *Notovola alba*.

Right valve deeply convex, with sixteen ribs, white inside and out, stained with brown or red. Left valve flat, whitish, stained with red inside and out. About 4 inches. Good to eat and appetising. Tasmania cans and exports Scallops, but the industry is not yet established in South Australia, although we have plentiful supplies between Cape Jervis and Kangaroo Island.

Fan Shell. *Equichlamys bifrons*.

The two convex valves are not quite equal in size, the left valve slightly overlapping the right. The principal ribs number about seven, with numerous smaller ones, and granular sculpture between them. The ribs are dark purple or rose colour. Interior of shell is very dark purple. Scallops are good eating. Put them in a lid on top of a hot stove, where they die almost at once, and the valves open. They may be left to stew in the salt water contained in the shell, until it is nearly all exhausted, when they are taken off. Next remove the thin tough mantle skin cover, and eat the rest hot with pepper and vinegar. There are immense beds of these tasty morsels between Cape Jervis and Penneshaw, and probably in many other situations round our coasts. In life they flit about in a zig-zag course, like submarine butterflies. This is accomplished by slightly opening and then rapidly closing the valves. Average adult measures 3 inches.

Prickly Fan. *Mimachlamys asperimus*.

The valves bear prickly scales and feel like a file when the fingers are drawn over them from the rounded edge upward to the straight hinge line. The auricles or ears are of different sizes, the one at the front end being the larger. The principal ribs number about thirty, each having a smaller one on each side. Colour may be yellow, orange, brown, scarlet, or purplish. About 2 inches.

Thorny Oyster. *Spondylus tenellus*.

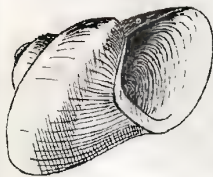
The radial ridges bear spines of the same substance as the shell itself. Colour, scarlet-rose, scales pale. During life the shell is attached by its right valve to rocks or other objects, consequently the single valves cast up are usually left valves. Complete examples are often cast up at Port Lincoln. About 3 inches.



Worm Shell
Vermicularia sipo



Split Worm
Siliquaria australis



Violet Snail
Ianthina violacea



Cap Shell
Sabia conica



Spiral Shell Limpet
Sigapatella calyptraeformis



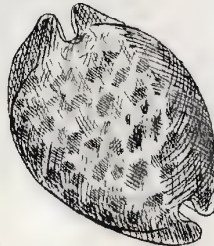
Sand Snail
Uber conicum



Ear Snail
Ectosinum zonale



Brown Cowry
Notocypraea verconis



Black Cowry
Zolla thesides



Helmet Shell
Hypocassia bicarinata



Triangle Murex
Pterynotus trifurcatus



Dog Whelk
Neothais textilis



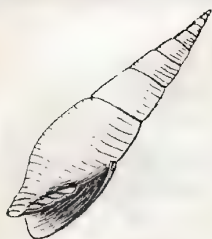
Tulip Shell
Fasciolaria australasia



Spindle Shell
Colus australis



Southern Olive
Olivula australis



Smooth Mitre
Mitra glabra



Southern Mitre
Mitra australis



Wavy Volute
Amorena undulata



Lightning Volute
Ericusa fulgetrum



Lyre Shell
Lyria mitraeformis



Sea Bubble
Bullaria tenuissima



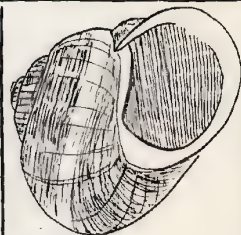
Pond Snail
Lymnaea subaqualilis



Left Handed Pond Snail
Amoria tenuistriata



Amber Snail
Succinea australis



Helix aspersa
Common Snail

Perforated Oyster. *Monia ione*.

Irregularly rounded, flat, thin. Colour, outside white, inside green. Lives affixed to Razor Shells and others by a horny plug, which passes through a large perforation in the right valve. About $1\frac{1}{2}$ inches. Shape of shell varies according to the adjacent surface. Is not related to the Port Lincoln Oyster, and is not edible.

Chestnut Mussel. *Modiolus inconstans*.

Colour, chestnut. Lives many together, moored by its byssal threads in mud between tide marks. About $1\frac{1}{2}$ inches.

Horse Mussel. *Modiolus areolatus*.

Lives a solitary existence and is sometimes cast up in sponges or partly embedded in clumps of worm-tubes (*Serpulae*). The narrow end is the front. A beard-like covering is usually present on the rear half. Shell colour, chestnut-brown. Length, 4 inches.

Black Mussel. *Modiolus pulex*.

Gregarious in masses on rocks and jetty piles. It is moored by root-like byssal threads. Front end narrow. Shell colour, bluish under a black periostracum. Interior brownish-blue or bluish-white, slightly iridescent. Length, one inch. Mixed up in the clumps of Black Mussels there is often present a tiny pea-shaped bivalve shell, colour whitish splashed with pink, named *Kellia australis*.

Beaked Mussel. *Brachydontes erosus*.

Variable in shape, with hooked beaks and a variable number of radial thick granulose ribs. Colour, brown, often tinted opal-green; interior dark purplish. Lives, usually in colonies, attached by the root-like byssus to rocks. The byssus passes through a gap in the valves near the front narrow end. About 2 inches.

Rock Shell. *Cleidothaerus albidus*.

Very solid, white outside, light-greenish and somewhat pearly within. Lives with the right valve cemented to stones or other objects in shallow water. About 2 inches.

Giant Cockle. *Eucrassatella verconis*.

Posterior end attenuated and angular; front rounded. Periostracum or shell covering

brown, thick, persistent. Left valve with two principal hinge teeth, right valve with three, the posterior one more or less rudimentary. Beaks rose tinted. Shell smooth or with concentric ribbing near the beaks. About $3\frac{1}{2}$ inches. The heaviest bivalve Mollusc now inhabiting South Australian waters. Aborigines of the Coorong and Encounter Bay used it as a knife or hand axe.

Scale Ribbed Cockle. *Cardita crassicosta*.

Radiating ribs very strong, raised into arched scales. Colour, red or pink, occasionally yellow. Lives in shallow water, moored by the root-like byssal threads. About 2 inches.

Rough Cockle. *Chama ruderalis*.

Concentrically frilled with wavy rows of short irregular tile-like spines. White, sometimes tinged with pink. About $1\frac{1}{2}$ inches.

Heart Cockle. *Cardium racketti*.

Plump, with many fine radial ribs. White or yellowish under a dirty-grey covering. Beaks pink to purple. About 2 inches. Most abundant on Kangaroo Island and Yorke Peninsula.

Wheel Cockle. *Circe weedingi*.

Almost flat, slightly corrugated concentrically. Colour, cream or very light fawn. About 2 inches. More common in Spencer Gulf than in Gulf of St. Vincent.

Frilled Cockle. *Callanaitis disjecta*.

About ten concentric, flesh-coloured frills, which are radially lined on the under side. Lives in sand near low tide mark. About $2\frac{1}{4}$ inches.

Sand Cockle. *Katelsysia scalarina*.

Fairly regular, concentric ridges, crossed by crowded incised lines. Creamy white, freely dotted with light brown in zig-zag. Lives in sand at extreme low-tide. About $1\frac{1}{2}$ inches. Used for food, fresh and pickled, and also as bait for fishing.

Milk Stone Cockle. *Venerupis galactites*.

Somewhat inflated, beaks towards the front end. Colour, milk-white, or greyish, or greyish-brown. Closely lined criss-cross. About $1\frac{1}{2}$ inches. The beaks are sometimes tipped with purple. A littoral shell.

Sunset Shell. *Tellina albinella*.

Oval, rather thin, flattish, shining, front end rounded. A slight ridge from the beaks obliquely to the rear end. Rose colour, pale-orange, or white, the last usually having pale-orange or yellowish near the beaks. About $2\frac{1}{2}$ inches. Sandy beaches, but most abundant south of Middleton.

Double-rayed Sunset. *Soletellina biradiata*.

Gaping at both ends. Colour yellowish, with purple to reddish at the beaks, also two whitish radial rays at the hinder end, which is slightly angulated. Often seen, between tide marks, with the rear end slightly protruding from the wet sand. About $2\frac{1}{2}$ inches.

Goolwa Cockle. *Plebidonax deltoideus*.

Wedge-shaped, the rounded end in front. Colour greenish, tinged with rose or sometimes blue. About 2 inches. Abundant on the sandy shores extending southward from Middleton; also Port Lincoln and Kangaroo Island. It is eaten fresh and pickled. Greatly valued as bait, and is sold in Adelaide shops for that purpose. Aborigines work their toes in the wet sand searching for these cockles.

Southern Cockle. *Macra australis*.

Rather triangular, rounded in front. Concentrically lined, very dense. Glistening, banded with light-grey and violet beneath a pale-brown transparent covering. About $1\frac{1}{2}$ inches. Very common on sandy beaches near Adelaide.

White Cockle. *Macra pura*.

Rounded front side slightly shorter than the rear. Ivory-white beneath a light-brown silky covering. About 2 inches. An attractive shell and quite common on sandy shores. Plentiful towards the Outer Harbour.

Tusk Shell. *Dentalium bednalli*.

Shell curved, tubular, open at both ends. Seven strong, rounded ribs, which tend to split near the larger (front) end. The smaller opening serves as outlet for organic waste. The animal has neither eyes nor tentacles. Lives embedded obliquely in mud or sand, with only the smaller end of the shell projecting into the water. About one inch.

**Paper Nautilus. *Argonauta nodosa*.
(On cover).**

The animal has eight arms and is related to the Octopus. The males are much smaller than the females. The "shell," which is secreted from the glandular membranes of the dorsal arms of the female, functions as an egg-nest as well as a partial retreat for the female argonaut. The male has no shell. The occupant can quit the shell at will, as it is not a molluscan shell in the same sense as that of Pearly Nautilus, Cowry or Cockle. The ribs of the shell are regularly broken up into tubercles, usually rather coarse. Greatest length, up to (exceptionally) 10 inches. We were formerly of opinion that *nodosa* was the only species in South Australian seas, but we are now persuaded to the contrary. A well-known and experienced collector, on Troubridge Shoal, near Edithburgh, in three years took more than 500 Paper Nautilus shells, of which about 10, he says, were *Argonauta argo*. This species is compressed, having the keel very narrow; ribs close, numerous and bifurcating. The tubercles on the ribs, which distinguish *nodosa*, are absent. Collectors who may be fortunate enough to take the animal with the shell, of either species, are invited to put the body into spirit and lodge it safely in the South Australian Museum, where its presence is desired. At the same time it is hoped than an opportunity will be given to view the shell, in order to attach the correct label.

Post Horn. *Spirula spirula*.

Most molluscan shells contain the soft animal parts. *Spirula* is an exception, the shell being internal. Shell spirally coiled, with several chambers, each partition or septum having a convex face towards the initial chamber. About one inch. *Spirula* lives in very deep water and dead shells are carried great distances by ocean currents.

Squid Pen. *Sepioteuthis australis*.

The common Squid of South Australia is eaten by Southern Europeans here, and fishermen use it as bait. Body almost diamond-shape, with eight short arms and two long tentacular arms, all bearing suckers. Head small, eyes large. Beaks, in the centre of the circle formed by the arms, closely

resemble the beaks of a parrot, except that the lower hook closes over the upper one. The "pen" (equivalent to a shell) is internal, feather-shaped and somewhat horny in character.

Cuttle Bone. *Sepia novaehollandiae*.

The common Cuttle has eight short arms and two long tentacular arms, all with suckers. Head broad, eyes large. Cuttle Bone (or internal shell) is about three-quarters of the animal's length, and is mainly of soft, porous shell-matter, with a strong, oblique spine at the rear end. Cuttle Bone about 6 inches.

Port Elliot Chiton. *Poneroplax costata*.

Eight overlapping segments or valves, held in position by a large muscular girdle. Colour green and brown, with cream markings. All valves, except the front one, have on each side a diagonal rib running from the central posteriorly placed micro to the front margin. Length, 3 inches. On the surface of rocks in exposed positions. Chiton Rocks, near Port Elliot, were so named after this Mollusc. *Poneroplax albida* differs in having a wrinkled appearance, and is often found where only the highest tides can reach it.

Round Back Sea Ear. *Haliotis cyclobates*.

Nearly circular, with a round back. Spiral apex elevated. Colour consists of broad radial patches or stripes of chestnut, green, flesh colour or whitish. About three turns of the shell, the last and largest with the last five holes, which have their uses, open. Interior silvery, with red and green reflections. About 2½ inches. Live attached to rocks or other shells.

Keyhole Limpet. *Sophismalepas nigrita*.

Both extremities slightly elevated. Orifice nearly central or a little behind the middle. Colour, dark brown, rayed with darker. Animal, rose colour above, yellow below, snout brown, tentacles orange. About half-an-inch. Alive on the underside of rocks.

Common Limpet. *Cellana tramoserica*.

Some are much more elevated than others. Colour variable, usually yellowish-brown, with white-spotted, dark-brown or black rays

Radial ribs close-set. Interior glossy, with greenish opalescent gleams. About 2 inches.

Hoop Shell. *Thalotia conica*.

Conical of about seven turns, wound with many spiral threads. Colour pinkish or greyish-white, with crimson apex, and numerous close longitudinal dark reddish-brown stripes. About three-fourths of an inch. Very common on sandy beaches.

Ribbed Winkle. *Austrocochlea torri*.

Conical, of four to five turns, with about ten weak spiral ribs. Dull grey or whitish. Mouth black-margined within, and notched where the ribs terminate. About one inch. Very common on exposed rocks.

Wavy Winkle. *Austrocochlea concamerata*.

Roundly conical of five turns, with about fifteen strong spiral ribs. Colour, yellow and black, tessellated or longitudinally striped. Mouth margined inside with yellow and black, followed by a white thickening; the aperture contracted by two tooth-like prominences at the lowest part. About one inch. Lives, many together, under stones between tide marks, on rocky shores, like Marino Rocks.

Adelaide Winkle. *Austrocochlea adelaidae*.

Roundly conical, of five turns, with shallow spiral grooves. A dark shell with fine white lines crossing the spirals. The small top turns, when beach worn, are orange coloured. About half an inch. Lives in rocky situations.

Granular Ear Shell. *Stomatella imbricata*.

Ear-shaped, creamy-white with scattered dots of reddish-brown. Interior silvery, iridescent. About 1½ inches. Alive on stones under rocks.

Common Warrenner. *Turbo undulatus*.

Top shaped, bluish-green with longitudinal white zig-zag streaks. About four spiral turns, faintly grooved. Operculum or trap-door calcareous, solid, white. About 2 inches. Common in rocky localities. Boiled and eaten with pepper and vinegar, the animal is good food.

Heavy Top-shell. *Turbo torquatus*.

Spirally depressed, about four bulging spiral turns, with numerous rounded ridges crossed by a multitude of longitudinal rough, flaky lines of growth. Colour, dirty greenish-grey. Base, spirally perforate to the apex, white. Mouth pearly within. Operculum solid, white, with ear-like prominences. Up to 5 inches. In rocky situations, chiefly on ocean shores.

Pheasant Shell. *Phasianella australis*.

Spirally elongated, rather thin, smooth, of about eight convex turns. Mouth pear-shaped. Operculum shelly, bluish-white, spiral on inner side, a long rounded prominence on outer side. About 3 inches. Brilliant coloration, the pattern extremely variable, tints of red, rose, and pink are common, cream is rarer. Common all along the shores of Southern Australia. Lives in the midst of a light green sea-plant called *Cymo doceo australis*.

Variegated Pheasant. *Phasianella angasi*.

Much smaller than the last named, spiral turns narrower, shell thicker, more variable in shape. Colour, reddish and greyish bands, and numerous zig-zag or dotted markings of darker colour and an intrusive pattern of lighter colour on the red. Up to one inch. Ocean beaches; very common at Middleton, where the lip of the shell is usually broken.

Black Crow. *Nerita melanotragus*.

Back rounded, spire low, of three turns. Very shallow grooves, criss-cross with very many growth lines. Colour black; mouth white like porcelain, with two or three tooth-like projections in the middle, and a larger one on the rounded inner edge. Operculum pale purple, granulate on the outer face. One inch. Lives under stones between tide marks.

Screw Shell. *Turritella iredalei*.

Gradually tapering to a point. About seven-teen turns bearing two prominent ribs, spirally wound. Colour, brown in life; beach specimens almost white. Nearly 2 inches. Common.

Wentletrap. *Scala delicatula*.

Elongate, tapering, about eleven spiral turns almost separated by a deep spiral groove (suture), with nearly twenty longitudinal prominent thin ribs. Translucent white. Scarcely one inch.

Worm Shell. *Vermicularia siphio*.

Wormlike, coiled, sometimes in colonies, often attached to other shells. Brownish, with rugged growth lines. Spiral turns, irregularly twisted. About 1½ inches, occasionally larger.

Split Worm. *Siliquaria australis*.

Worm-like, tubular, coiled, about five turns, with a longitudinal split formed by a series of perforations. Reddish-brown in life (beach specimens whitish). About 3 inches. Lives in purple coloured sponges, which are sometimes cast up and common on Sellick's Beach.

Violet Snail. *Ianthina violacea*.

Rounded, thin, fragile, of about four turns. Colour violaceous—white on the depressed spire, uniform violet on the base and about the mouth. Scarcely one inch. These "blind snails of the sea" live in myriads, floating with the mouth of the shell uppermost, in the warm and temperate oceans, each attached to one end of a long gelatinous raft or float, filled with bubbles of air. To the undersurface of this float the egg-capsules are attached. They feed on small jelly fishes. When touched, they exude a violet fluid which clouds the water around.

Cap Shell. *Sabia conica*.

Cap shaped, apex to the rear and directed backwards. Grooved longitudinally. Colour, pale reddish, beach specimens white. Interior like porcelain, reddish-brown in centre and white on margin. One inch. Lives attached to other shells.

Shelf Limpet. *Sigapatella calyptraeformis*.

Slightly convex, rounded, thin, yellowish-brown, beach examples whitish. Interior with a shining white basal plate or shelf. Scarcely one inch. Lives attached to stones or other shells.

Sand Snail. *Uber conicum*.

Conical, fawn colour, of five turns, the last turn disproportionately large. Mouth more than half the height of shell. Basal perforation small. About $1\frac{1}{2}$ inches. Between tide marks; its burrow in the sand has a raised roof, and at one end lives the Sand Snail. The eggs are arranged in collar-like wide bands formed of sand incorporated with a gelatinous material. These egg bands are often cast up in the spring.

Ear Snail. *Ectosinum zonale*.

Ear shaped, only slightly convex, of about three turns, the first two very small. White; living specimens have a yellowish covering. About one inch. Animal is much larger than the shell and not retractile within it.

Brown Cowry. *Notocypraea verconis*.

Nearly oval, the broad end is at the rear. Highly polished, chocolate brown, margins whitish with numerous smeared dark brown spots. Base white, mouth as long as the shell with a tooth-like arrangement nearly the whole length, about 27 teeth on the right margin sloping into the aperture. Water to aerate the gills is received through the notch at the front, the waste water being discharged by way of the posterior notch. About one inch. On the underside of rocks just beyond low tide. Other kinds of small Cowries are spotted or banded.

Black Cowry. *Zoila thersites*.

Large, hump backed. Heavily splashed on the back with dark reddish-brown and cream between the splashes. Entire circumference of base nearly black. Teeth white, about 27 on the right side; only a few teeth at the front end on the left side. Nearly 3 inches. On sponges in a few feet of water and taken therefrom in long handled nets. The Paper Shell Cowry is the immature form and is more pear-shaped. Animal is black.

Helmet Shell. *Hypocassis bicarinata*.

The notched end is the front. Light fawn and white, circled by spiral lines of dark brown alternating with white; about six brown bands on the reflected outer-lip. Closely longitudinally lined. The shell has five turns. About 3 inches. Burrows in sand which helps to retain the polish.

Triangle murex. *Pterynotus triformis*.

Angularly elongate; triangular when viewed with the spire in the foreground. Six turns ending in a frill. Mouth oval with a long, narrow, curving canal at the base. Colour, brownish to deep purple. About 3 inches. Closely related species in the Mediterranean provided the purple of the ancients, the same species to-day are sold for food on the coast of the Adriatic.

Dog Whelk. *Neothais textiliosa*.

Oval, swollen, of about $3\frac{1}{2}$ turns, the last turn large. Yellowish-white, and sometimes pinkish-yellow above the basal notch. About ten spiral ribs, faintly cut by longitudinal grooves. Mouth oval, outer lip grooved inside. About 3 inches. On rocks at low water.

Tulip Shell. *Fasciolaria australasia*.

Spindle-shaped, swollen, shining, dark brown, of about six turns, well rounded, spire high. Three plaits on the central column. About 4 inches. Amongst sea grasses at about low tide. Beach rolled shells yellowish.

Spindle Shell. *Colus australis*.

Spindle-shaped, spire high, basal canal long. Brownish-red to yellowish. About nine turns, rounded, having many spiral ridges. About $4\frac{1}{2}$ inches. In life the long canal is the front and goes first.

Southern Olive. *Oliva australis*.

Porcellaneous, whitish or yellowish, with brown markings dividing the turns, a yellowish-brown streak obliquely from the frontal notch; often also brown spots on the back. About five turns, the last elongate. The lower third of central column obliquely grooved. About one inch. Rivals the small Cowries in popularity. Fairly common on sand spit next Royal Yacht Squadron harbour.

Smooth Mitre. *Mitra glabra*.

Spindle-shaped, the spire pointed. Polished, yellowish-brown with a blackish-brown covering (periostacum). Nine spiral turns, dividing line impressed. Central column with four plaits, of which the highest is the largest. About $3\frac{1}{2}$ inches. On sand flats in shallow water.

Southern Mitre. *Mitra australis*.

Shorter than the Smooth Mitre, brown, encircled throughout with a single spiral, light-coloured, brown-stained belt. Central column brown, with four strong white plaits. About $1\frac{1}{2}$ inches. Common on sand spit, Outer Harbour.

Wavy Volute. *Amorena undulata*.

Somewhat spindle-shaped, of four spiral turns, smooth, polished, spire short. Central column with four strong plaits. Cream coloured with many longitudinal, zig-zag, chestnut lines; central column and shell interior bright red-orange. Mouth channelled above, notched below. About 3 inches. Shallow water, on sand banks.

Lightning Volute. *Ericusa fulgetrum*.

Somewhat spindle-shaped, of six turns, the initial turn set obliquely. Yellowish-flesh colour with zig-zag brown dashes, which tend to form two spiral rows of blotches. The blotches are arrow-headed, with their concavity towards the outer lip. About 5 inches. Alive on ocean sand banks covered by about 18 inches of water at low spring time.

Lyre Shell. *Lyria mitraeformis*.

Oval, spindle-shaped, of five spiral turns; dividing line deep. Many rounded, prominent, longitudinal ribs. Colour, cream with numerous dark brown squarish patches. Central column with three almost horizontal plaits, and several weak wrinkles above. About 2 inches. Alive on sand banks near low tide mark at Outer Harbour.

Sea Bubble. *Bullaria tenuissima*.

Oval-cylindrical, shining, spire sunken; mouth high, extending beyond the spire, narrow above, enlarged toward the base. Yellowish-brown, marbled with darker; sometimes spirally banded. About 2 inches. In life, in sandy mud. Animal bulky, but capable of complete retraction within the shell.

LARGE SEA URCHINS FROM NEW GUINEA

A large Heart Urchin, or Spatangoid, was recently sent to the South Australian Museum by the Rev. H. Bartlett, from Brooker Island, New Guinea. It measures six inches long, five inches wide, and three and a half inches high. This is the largest specimen of its kind so far received. Dr. C. M. Deland forwarded a number of large Sea Urchin Spines from Manus, New Guinea, pro-

Pond Snail. *Lymnaea subaquatilis*.

Spiral, thin, of four turns. Pale horn-coloured, longitudinally lined. Mouth half the length of shell. Scarcely half an inch. Among herbage growing on the marshy margins of River Torrens.

Left Handed Pond Snail. *Amerianna tenuistriata*.

Spiral, with four left-handed turns. Dark olive colour, with criss-cross striations. About one-third larger than the Pond Snail. Rivers Torrens and Onkaparinga.

Amber Snail. *Succinea australis*.

Spiral, fragile, almost transparent, of three turns, the last disproportionately large. Pale horn colour, sometimes with darker streaks. Longitudinal striae rough. About half an inch. Under stones on high lands bordering the coast. Amber Snails are usually a little too big for their shells. Dead bleached shells are pale bluish.

Common Snail. *Helix aspersa*.

Ground colour, brownish-yellow, with five very dark brown bands; but these are broken and the yellow appears as zig-zag streaks.

About five turns; spire not much raised; lip white, thickened and reflected. About $1\frac{1}{2}$ inches. Eggs average about one hundred, deposited in cup-shaped hollows among herbage and covered with a little loose earth.

The young come forth with the same shape as their parents, carrying a tiny, glassy shell.

They become adult in about a year and live three to five years. They have their regular roosting places, from which paint-marked individuals have been noted to emerge at evening and return next morning.

In hot, dry weather they remain at home and wait for rain. This common garden snail was imported to South Australia from Europe.

probably belonging to an urchin of the *Phyllacanthus* type. *Phyllacanthus longispinus* Mortensen, 1918, is recorded from the Northern Territory and Western Australia, and the largest spines are said to be 90 mm. in length (about $4\frac{1}{2}$ inches). The spines forwarded from Manus are up to 128 mm. (over 5 inches) long and 15 mm. (over $\frac{1}{2}$ inch) in thickness. It would be interesting to see a living urchin of this species, which must measure well over 12 inches across from tip to tip of the spines.

B. C. COTTON.

The Distribution Of South Australian Mistletoes And The Mistletoe Bird

By

J. B. CLELAND.

Professor Ralph Tate, in an article entitled "The Host Plants of the Australian Lorantheaceae" (Rep. Seventh Meeting Australas. Ass. Adv. Sci., Sydney, 1898, p. 553), in reference to the Mistletoe Bird (*Dicaeum hirundinaceum*) says that "both bird and mistletoe are absent from the large adjacent insular lands of Tasmania and Kangaroo Island. An extensive tract of lightly timbered country on the eastern slopes of the Adelaide chain has also neither mistletoe nor *Dicaeum*."

As regards Kangaroo Island, a rare mistletoe (*Loranthus mirabilis* Miq. var. *Melaleuca* Tate) has now been recorded on *Melaleuca* sp. (E. H. Ising, "S.A. Naturalist," XIV, 1933, pp. 67 and 127).

On June 25, 1940, on a journey to Swan Reach, passing through Mt. Pleasant, on the road to Cambrai on the Murray Flats, I had an opportunity of seeing some of the eastern slopes of the Adelaide chain referred to by Professor Tate. From Gumeracha to Mount Pleasant the country was undulating, with scattered Red Gums (*Eucalyptus rostrata*) which are unusual hosts for mistletoe. On some of the hill tops in the distance scrub was present, with apparently *E. elaeophora*, but I was not close enough to see if this had mistletoe, which it often has. Near Mt. Pleasant there were some Manna Gums (*E. viminalis*) along the creek. Mistletoe was not noticed on any of these trees. The real eastern slopes began after leaving Mt. Pleasant and Mr. Melrose's station. Before reaching Cook's Hill, overlooking the Murray flats, occasional *E. leucoxylon* and Sheoaks (*Casuarina stricta*) were seen. Descending the hill, *Loranthus Exocarpi* was seen on a number of the Sheoaks. Red Gums, free from mistletoe, were present in the creeks. On reaching the plains one mistletoe was

seen on a Peppermint Gum (*E. odorata*). Near Cambrai there was much Peppermint Gum, but no mistletoe. At Swan Reach, one Red Gum was noticed attacked by four or five mistletoes; this is an unusual infestation.

The return journey was made through Keyneton and thence to Mt. Pleasant. East of Keyneton there were Peppermint Gums, many with mistletoes on them, apparently some *E. leucoxylon* without mistletoe, and Red Gums along the creeks without mistletoe. Near Keyneton, *Loranthus* was abundant on *E. leucoxylon*, several trees being killed by it; possibly some of the trees affected were Red Gums. Red Gums round Eden Valley and occupying the undulating slopes through Springton to Mt. Pleasant were free from mistletoe.

On August 22, travelling by train from Nairne to Callington, the eastern slopes were again inspected for mistletoes from the train window. The railway line winds down a long open valley through open country with very few trees. No mistletoes were seen on Red Gums or Sheoaks, but *Loranthus* was present on a number of Peppermint Gums (*E. odorata*) which appeared as the descent of the valley progressed.

Summary: From the above it will be seen that mistletoe has occurred on Kangaroo Island and that mistletoes do occur in places along the lightly timbered country on the eastern slopes of the Mount Lofty ranges, being numerous where the trees are close together, as in the Peppermints and Blue Gums near Keyneton. Much of this country has very scattered timber and is occupied by Red Gums, which naturally are unusual hosts. It would appear that any immunity that this region enjoys is partly due to the kind of trees which grow there and partly to their widely separated distribution.

Eye Colour In Australian Birds

GENERAL CONSIDERATIONS

By
H. T. CONDON

The subject of eye colour in birds is one of great interest to the ornithologist, the aviculturist and the geneticist. Its value as a factor in identification of species has long been recognised by ornithologists, while the aviculturist also has realised its sex-linked character and employs it as a means of determining sex, notably among parrots. It is also a useful guide to the relative ages of birds of many species.

Colour of the iris may arise in several ways. It may be due to the presence or absence of pigment granules in the anterior portion of the eye, to the presence of masses of capillary blood vessels, or to a special structural condition resulting in the reflection of certain light rays, such as blue.

The pink eyes of albinos are due to the absence of dark pigment, such as melanin, which results in the blood in the capillaries of the eyes alone being visible.

The novice frequently confuses the pupil with the iris. In dark-eyed birds it is often difficult to determine the exact limits of the pupil, which may be small or large. There are often frequent changes in the size of the pupil owing to varying conditions of light or mental excitement. In birds other than albinos the pupil appears black. On occasions also the highly-coloured eyelids of some birds have been mistaken for the coloured iris by observers. In the Silvereye (*Zosterops*) the eye is surrounded by a ring of white feathers. Considering the range of variation in eye colour of birds, it is rather surprising to find that collectors and painters of birds generally have shown a lamentable disregard for this important feature. It is the exception rather than the rule to find data recording the colour of eyes on labels attached to museum specimens. The value of many skins is largely reduced because of such omissions. Glass eyes indiscriminately used in mounted birds are a feeble substitute for the real birds' eyes with their subtle gradations and wealth of colour.

Eye Colour in Young Birds.

The eyes of a new-born European human infant are deep blue, and this condition is seen to persist in some adults. In birds, also, the infantile condition of the eyes persists in some instances throughout life, e.g., white fantail pigeon (Bond).

The eyes of many newly-hatched birds are dark in colour owing to the absence of pigment on the anterior portion of the eye, so that the dark uveal epithelium beneath is revealed. In many birds further pigment soon appears and the eye then assumes another colour.

In the newly-hatched young of Ravens, *Corvus coronoides*, for example, the rather expressionless eyes are bluish in colour, with a glassy appearance. By the time the nestling down has been replaced by contour feathers the iris has become more clearly defined. When about three months old the iris assumes a light brown ("Sepia" of Ridgway), which in one example noted by the writer, seemed to vary in quality from day to day. In this bird, a female taken from a nest near Adelaide, the iris had assumed a dirty white colour by the time the bird had reached the age of 12 months. The iris was not one colour, however, but was composed of several concentric coloured rings. Sepia in the centre and grading to almost white near the periphery. Another bird of unknown sex, which had brown irides when a few months old, assumed china-white irides at about six months, but the writer feels that this bird, because of its smaller size, was a Little Crow, *Corvus bennetti*, although also taken near Adelaide, which is generally regarded as beyond the southern limits of this species.

In the Silver Gull (*Larus novae-hollandiae*) and Pacific Gull (*Gabianus pacificus*), the iris is pure white in fully adult birds, but in the young of both species it remains light brown (sepia) for a considerable time. In the case of the Silver Gull, the iris only changes to white after the loss of the brown

teleoptiles of the young stages, when the bill, eyelids, legs, and feet, also assume the deep scarlet colour of the adult. The Pacific Gull remains in brown plumage for about four years (when they are wrongly called Molly-hawks or Jack Gulls) before gradually changing to white with dark wings, and birds in this brown plumage have brown eyes.

The Yellow-winged Honeyeater (*Meliornis novae-hollandiae*) is another white-eyed bird which is brown eyed in the nestling and juvenile stages. The sexes are alike when adult in all the abovementioned species.

Further investigations will probably reveal that the eyes of most birds undergo marked changes in colour during the various stages before reaching maturity. In the White-winged Chough (*Corcorax melanorhamphus*), nestlings and juveniles have light brown eyes. In adult birds the irides are scarlet, this apparently being due to the presence of yellow cell granules in the anterior parts of the eyes which, in conjunction with blood capillaries, gives the irides a scarlet appearance. Eyes removed from a dead Chough and placed in "pickle" (30% methylated spirits) soon became orange-red in colour, which colour remained.

It is of interest to record also that in the Chough the outer zone of the iris where blood vessels abound, is more intensely scarlet than the inner zone surrounding the iris, which is orange.

In Parrots the presence of a dark eye in certain species of *Kakatoe*, etc., is regarded as an indication of male sex, and dealers in birds separate chicks as well as older birds by this means. This method does not appear reliable, however, in the case of young birds, as the orange and red irides of females in certain species do not appear as such until the birds are practically mature.

Recording Eye Colour in Birds.

The utmost care should be taken when noting the colours of birds' eyes. If a standard colour chart (such as Ridgway's) is not obtainable for comparison, care should be taken to distinguish between red and scarlet and crimson, red and orange, red and brown, chrome yellow and lemon yellow, blue and green, hazel and sepia (see below), black and dark brown or dark blue, grey and white.

Different people have different conceptions of colour. In many birds with light brown, i.e., sepia irides, this colour is often wrongly stated as hazel, i.e., a deep orange, somewhat approaching a reddish brown. It is important in the case of slaughtered birds and others to note the colour *immediately* after death, as it may alter with great rapidity, and the sex and, if possible, ages of the birds should also be recorded. In observing the living bird, of course, the eye colour can only be noted with difficulty in many cases, and less reliance can be placed on results obtained in this way.

Some years ago it was claimed that the irides of the Chough only assumed a scarlet colour when the birds were alarmed or annoyed, but the writer is not convinced and feels that sufficient evidence has been obtained to disprove the story (see above).

Eye Colour and Plumage Colour.

There seems to be no apparent relationship between eye colour and plumage colour, except in the case of albinos, when the eyes are always pink or "red." The commonest colours seem to be brown or sepia, yellow, hazel, black, white, various shades of "red," grey, green (as in Cormorants), while blue is apparently rare (in some Birds of Paradise).

Dark eyes, such as sepia, brown, and black usually occur in dark coloured birds. There are a great many exceptions, the Australian Raven (*Corvus coronoides*) being an outstanding one, as although the eyes are dark in the young they are *white* in the adult!

Eye Colour as a Sex-Linked Character.

Experiments with captive birds as well as observations amongst wild birds show that eye colour is a sex-linked character.

It also appears to be a generic feature, as individuals of various species of a genus usually pass through similar changes in eye colour before reaching maturity.

This is well exemplified in members of the Parrot tribe. In the genus *Aprosmictus* the young birds have brown irides. In the adult females the colour is dark brown, while in the males it is scarlet (*A. erythropterus*, Red-winged Parrot), and pale yellow (*A. scapularis*, King Parrot, Vic.).

In the Cockatoos (genus *Kakatoe*) the eyes of young birds are usually brown, while in the adults the colour is black or very dark brown in males and pale brown or reddish in females, as listed below. White Cockatoo (*K. galerita*), male, black; female, reddish-brown. Pink Cockatoo (*K. leadbeateri*), male, black; female, scarlet. Corella (*K. tenuirostris*), male, black; female, brown (?). Little Corella (*K. sanguinea*), male, blackish; female, red. Galah (*K. roseicapilla*), male, black; female, dull orange-red. In the case of the Galah, the iris of the male has generally been given as dull orange-red (e.g., North, Cayley), but this apparently applies to examples from New South Wales, as a skin from that State in the S.A. Museum is so labelled, and may be indicative of a different geographical race or sub-species. In the genus *Trichoglossus*, the iris is scarlet in both sexes (*T. moluccanus*, Rainbow Lorikeet, and *T. rubitorquis*, Red-collared Lorikeet, N.A.), and also in young birds. An example obtained on Cape York, N.Q., however, had brown irides and was an adult female, perhaps suggesting another example of geographical variation.

In a number of genera of parrots the colour of iris is approximately the same in both sexes. Judging by the evidence available, this would appear to be the case in *Platycercus*, *Barnardius*, *Eclectus*, *Psephotus*, *Lepidolophus*, *Neophema* (all brown), and *Melopsittacus* (yellowish-white).

In *Lathamus discolor*, Swift Parrot, the iris is dark brown in the male and orange yellow in the female. In *Glossopsitta* the iris is brown in the immatures, but approximately the same colour in adults of both sexes, viz., orange-yellow (*G. concinna*); brown, (*G. porphyrocephala*); yellow (*G. pusilla*). In the Palm Cockatoo of North Australia the iris is dark brown in the young bird and adult male, and reddish-brown in the adult female. The male Gang Gang, *Callocephalon fimbriatum*, has a darker brown eye than the female.

In the genera *Calyptorhynchus* and *Polytelis*, I have been unable to obtain any comparative data on sexual differences. In the former genus the iris is usually stated to be dark brown in the male, and in the female it may be approximately similar. A nestling *C. lathami*, Glossy Black Cockatoo, from Kangaroo Island had greyish irides.

In *Polytelis* the eyes are rich yellow (*P. swainsoni*, Green Leek, Vic.); rich orange, (*P. alexandrae*, Princess Parrot); and hazel or reddish-brown, (*P. anthopeplus*, Rock Pebbler) in the male, but the colours in females have not been obtained.

Unless otherwise stated, the above observations are of South Australian examples.

In a future article I hope to discuss differences in eye colour in other families of birds.

The Original Flora Of The Adelaide Plains

By

PROFESSOR J. B. CLELAND.

Dr. W. H. Leigh, in "Reconnoitering Voyages and Travels," describes the country between Port Adelaide and Adelaide in 1837 as consisting of alternating belts of trees and extensive plains, giving a park-like appearance. Buttercups are noted. He mentions natives spudding up with a stick, on the plains near Adelaide, a kind of pig-nut, about as large as a little finger, white and milky and unpleasant to the taste like the dandelion.—This was, of course, *Microseris scapigera*, an addition to the flora of the plains, now apparently extinct there.

J. C. Hawker, in describing the Torrens, at Adelaide, in October, 1938 ("Early Experiences in South Australia," 1899, p. 7),

says, "here and there were patches of ti-tree growing." This presumably refers to *Lepidospermum pubescens*, the Silky Tea Tree that grows in water.

The following further notes and records of the present-day distribution of native plants have been made. An asterisk indicates a new record for the Adelaide plains.

GRAMINEAE:—*Themeda triandra* Forsk., Kangaroo Grass, Beaumont Common.
**Aristida Behriana* F.v.M., Highfield, near Beaumont, July, 1936. *Stipa variabilis* Hughes, identified Kew No. 417, near travertine limestone, University, May 1931. *Danthonia auriculata* Black,

identified Kew No. 419, abundant on paddock at Highfield. **Poa caespitosa* Forst., Beaumont Common, Nov.

CYPERACEAE:—**Eleocharis acuta* R.Br., Swamp near St. Saviour's Church, Glen Osmond, Dec., 1932.

LILIACEAE:—*Dianella revoluta* R.Br., Beaumont Common. **Lomandra micrantha* (Endl.) Ewart, Beaumont Common. *Bulbine bulbosa* (R.Br.) Haw., Beaumont Common, Sept.

LOGRANTHACEAE:—*Loranthus Exocarpi*, additional hosts: On *Crataegus*, Beaumont Common, on *Lagunaria*, Adelaide.

CHENOPODIACEAE:—*Rhagodia nutans* R.Br., Devereux Road, Beaumont, Oct., and Beaumont Common, June and Oct. **Atiplex semibaccatum* R.Br., Berry Saltbush, Knoxville, March, 1936. **Sal-sola Kali* L. Buckbush, Jubilee Oval, University, Feb. 20, 1936.

CRUCIFERAE:—**Lepidium hyssopifolium* Desv., Beaumont Common.

CRASSULACEAE:—**Crassula Sieberiana* (Schultes) Ostenf., Beaumont Common. *C. macrantha* (Hook. f.) Diels et Pritzel, Beaumont.

PITTOSPORACEAE:—*Bursaria spinosa* Cav., Native Box, Beaumont Common.

ROSACEAE:—**Acaena ovina* A. Cunn., Highfield, Oct.

LEGUMINOSAE:—*Acacia Victoriae* Benth., one plant growing spontaneously on waste land in Knoxville in 1939 and 1940. *A. ligulata* A. Cunn., Enfield.

GERANIACEAE:—**Erodium cygnorum* Nees, near Jubilee Oval, University, Sept., 1934.

ZYGOPHYLLACEAE:—*Tribulus terrestris* L., Caltrop, near Jubilee Oval, University, March, 1939.

CONVOLVULACEAE:—*Convolvulus erubescens* Sims, the late A. A. Simpson's garden at Burnside, and Highfield. **Calystegia sepium* (L.) R.Br., beside the Torrens, e.g., near the Zoological Gardens. *Dichondra repens* Forst. et f., abundant under trees, Parklands, South Terrace, Jan., 1937.

BORRAGINACEAE:—**Cynoglossum suaveolens* R.Br., Beaumont Common, Nov., 1931, Oct., 1937.

PLANTAGINACEAE:—**Plantago varia* R.Br., Beaumont Common.

GOODENIACEAE:—*Goodenia primulacea*

Schlecht., Mr. Moxon Simpson's garden, foothills, Burnside.

COMPOSITAE:—*Gnaphalium japonicum* Thunb., on tennis court at Beaumont, Nov., 1938. *Helichrysum semipapposum*, previously reported as probably this species, is confirmed in Beaumont Common.

Summary.

In the previous communications by Mr. J. M. Black, Mr. E. H. Ising and myself, 82 species (excluding those in the late Mr. A. A. Simpson's garden at Burnside) were recorded as still growing on the Adelaide plains. My record of *Danthonia penicillata* for Beaumont Common is probably an error for one of the other three species recorded, leaving a total of 81. The present list adds 13 further species, making a total of 94.

(For previous contributions, see in the "S.A. Naturalist," J. M. Black, I, No. 3, 1920, p. 42; E. H. Ising, V, No. 2, 1924, 111-113, VI, No. 1, 1924, 18-19, and XVIII, No. 4, 71; and J. B. Cleland, X, No. 1, 1928, 1-6, XII, No. 4, 1931, 68-69, and XIII, No. 3, 1932, 115-117.)

THE KALUTARA SNAIL

Achatina fulica Ferussac

ATTACKS RUBBER TREES IN CEYLON.

Five large snails were recently brought into the South Australian Museum by Miss L. L. Ayers, from Ceylon. Miss Ayers explained that they were taken from rubber trees which they were attacking. The Snails are *Achatina fulica* Ferussac, type locality Mauritius. They have evidently been introduced into Ceylon and are prospering, for the largest of the five specimens is just over five inches (128 mm.) long, being slightly larger than the largest specimen recorded by Pilsbry from Madagascar (123 mm.). *A. fulica* was introduced into Bourbon from Madagascar for culinary purposes, and in 1847 into Calcutta by Benson. It is also recorded from Seychelles and Comoro Island. The species is known by the negroes of Mauritius as "Couroupa." The *Achatina* species are common and large in South West Africa, and an individual lays about 200 eggs, which are small and very like those of a bird.

B. C. COTTON.

The Field Naturalists' Section

EXCURSIONS

1940			
Dec. 7—Brighton to Glenelg.	Train, 1.11 p.m.	Seaweeds	Mrs. R. W. Edmeades
28—Outer Harbor.	Train, 9.5 a.m.	Mud Flat Life	Mr. F. K. Godfrey
1941.			
Jan. 18—Long Gully.	Train, 1.14 p.m.	Trees	Mr. W. D. Wade
27—Victor Harbour. (6/-)	Motor, 9 a.m.	General	Mr. H. Greaves
Feb. 1—Blackwood.	Train, 1.14 p.m.	Exp. Orchard	Mr. R. Fowler
15—Millswood, 37 Ave St.	Tram, 2 p.m.	Aviaries	Mr. R. D. Spinkston
Mar. 1—Marino.	Train, 1.11 p.m.	Chitons	Mrs. A. R. Altman
8—Outer Harbor.	Train, 1.10 p.m.	Dredging	Mr. B. C. Cotton
15—Mt. Lofty.	Train, 1.14 p.m.	Flower Show	Mr. A. J. Morison
29—Glenelg.	Tram, 1.30 p.m.	Sand Dune Flora	Prof. J. B. Cleland
Apr. 15—Botanic Park.	Gates, 2 p.m.	Trees	Mr. H. Greaves
19—Grange.	Train, 1.13 p.m.	Shells	Miss C. M. Fea
25—Barossa (5/-).	Motor, 9 a.m.	Petrology	Mr. A. Kleeman

TRAM EXCURSIONS.—Meet in Grenfell Street, by T. & G. Building.

TRAIN EXCURSIONS.—Will members obtain their tickets and meet on the train.

MOTOR EXCURSIONS.—Meet at the Town Hall, Adelaide. Book with the Secretary or the Treasurer.

EVENING MEETINGS

1941.	1941.
Feb. 18—Conversazione, Lady Colton Hall, Y.W.C.A.	June 17—"South Australian Lepidoptera"
Mar. 18—"Color" Mr. A. K. Newbery	Mr. F. M. Angel
"Simpson Desert Flora," Mr. R. L. Crocker	"Orchid Studies" Mr. H. Goldsack
Apr. 15—"Goodeneaceae" Dr. M. T. Winkler	July 15—Malacological Society Evening
"Hills Flowers" Mr. W. D. Wade	Chairman Mr. W. G. Tucker
May 20—"South Australia and the Mineral World"	Aug. 19—Annual Meeting.
Dr. A. R. Alderman	

MALACOLOGICAL SOCIETY: Evening Meetings

1940.	1941.
Dec. 2—"Volutidae" Mr. F. Trigg	June 2—"Marino Chitons" Rev. B. J. Weeding
1941.	16—"Brachiopoda" Mr. W. G. Buick
Mar. 3—"Trochidae" Mr. B. C. Cotton	July 7—"Naticidae" Mr. B. C. Cotton
17—"Land Snails" Mr. W. M. Nielsen	21—"Fresh Water Snails" Mr. A. K. Beasley
April 7—"Shells Through the Ages"	"Rissoidae" Mr. B. C. Cotton
Mrs. L. A. Elliott	Aug. 4—Annual Meeting and Exhibits by members.
21—"Hydrozoa" Mr. F. K. Godfrey	18—"Patellidae, Lottiidae, Stomatellidae"
May 5—"Turridae" Mr. B. C. Cotton	Mr. B. C. Cotton
19—"Corals" Miss D. M. Matthews	